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ANTHROPOLOGY.—*Some applications of physical anthropology.*[1] ROBERT M. WHITE, Quartermaster Climatic Research Laboratory, Lawrence, Mass. (Communicated by T. D. Stewart.)

Just as some cultural and social anthropologists have adapted their particular fields to contemporary problems, so have some physical anthropologists drawn from their techniques and developed methods by which many problems of every-day living which involve dimensions of the human being may be subjected to scientific analysis and solved in an objective manner. Although the problems generally treated by fields of anthropology other than physical are more subtle and abstract in nature, their very subtlety and abstractness have presented challenges that have enabled professional anthropologists to engage in direct approaches to them, since they present fields of investigation in which no other people are prepared to engage. On the other hand, the physical anthropologist encounters large numbers of "experts" when he approaches any of the numerous problems he may solve or help to solve.

In general, we, as people, have become so well acquainted with all the various implements used by us physically that we suffer from the types of prejudices so well described by Gittler (1949). Clothing, furniture, automobiles, all are familiar to us from our early childhood. We develop specific ideas about them, aided considerably by advertising claims. Consequently, when we develop tired backs, or we feel cramped, we believe we are in the best furniture or clothing that can be made and so we, as people are at fault. The dissenting opinion of the objective investigator, merely expressed as a viewpoint, immediately arouses our antagonism. "I paid $150 for this suit, so it is perfect." "This automobile cost $2,500, so it cannot be improved upon." Such reactions should be familiar to all of us. Since these reactions are encountered among laymen, it is easy to imagine the attitudes or opinions expressed by designers of clothing and other items with which we come into physical association. Men who have made fortunes in the designing of clothing are hard to convince when we argue that they might improve upon their procedures. One of the greatest handicaps in reaching a mutual understanding with the designer or the engineer is the necessary use of statistical knowledge in explaining the problem. No one professional group attempts to use applied statistics more than does that engaged in clothing design and construction. Grading between sizes and sizes themselves are really applied statistics, but the use made of modern statistical concepts among that group is practically archaic. Although mechanical design engineers have benefited from training in mathematics, little, if any, statistical method has been included.

Since we, as people, are so well acquainted with all the various articles we wear or use every day, it comes somewhat as a shock to us to find that so little consideration has been given to us, as people, in the design of those articles. The common reaction expressed by most persons who are at first confronted by the idea that all is not right with the world is one of perplexed questioning. "How have we gotten along so well, so

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far, if this situation actually exists?" The answer is simple. The first chair was probably a stone or a log. Trial and error soon indicated its deficiencies. A pad of animal skin or grass considerably alleviated the concentration of pressures on the ischial tuberosities. By further trial and error a back was added, and so we have now a product, called a chair, which has shown little evolution from its primitive ancestor. Sporadically, claims are made that some chairs are functional. Seldom is the function specified. Rarely is it directed at comfort, objectively specified in terms of the human occupant. Claims are often made, but the proof is seldom present. Coincident with this situation in furniture is that existing in clothing. Design and size are considered to be integral. They are, but seldom does size have a known and provable relation to human bodily dimensions. It is of little interest to the designers of clothing that I wear a "size 38 Regular" in this year's style, and next year, even though my dimensions do not change, I wear a "size 40 Regular". The explanation is simple. I am a "38 Regular" in this year's style, and a "40 Regular" in next year's. Opposed to this type of free thinking is the plight of the retailer who stocks next year's inventory on the basis of this year's sales. The equalization occurs with a "stock reduction and clearance sale". Fortunately for the poor retailer, the designer and his style usually stay within three sizes in their variation, so that the retailer can operate at 80–85 percent efficiency.

All this should serve to orient us with the more direct aspects of the field into which physical anthropology has recently entered. Essentially, the scope lies almost within the range of engineering, whether it be termed as such, or whether it is such by method. In clothing, little has been accomplished which would warrant the term "engineering." In what is more commonly accepted as an engineering field, furniture, automobiles, etc., equally negligible accomplishments have been attained with specific reference to human beings. Two factors explain this condition. The first, and fundamentally the most important, is the lack of static and dynamic anthropometric data. Allied with this, although necessarily following it in demand, is the lack of statistical knowledge required to obtain proper application. The second, and of equal practical importance, is the universal attitude that the accommodation of the human being is a factor in the general field of competition. Whole industries are willing to standardize sizes of fittings, such as rims of wheels on automobiles, in order to accommodate tires made by another industry, but the perfectly simple concept of standardization of accommodation for human beings has not yet been accepted. The various commercial airlines are encountering a serious problem as a result of this type of situation. Pilot accommodations vary considerably among various aircraft (King, 1948). Consequently, when the suggestion is made that savings in time and money could be achieved by through-routing of aircraft over different lines, the pilots refuse, and wisely so, to accept responsibility of piloting aircraft that have cockpit arrangements differing markedly from those with which they are familiar. The armed services have been striving for the past five or six years to accomplish some form of cockpit standardization, and have made some progress, but the fulfillment of their efforts has yet to be realized in operational aircraft (Randall, 1946b).

Therefore, when the physical anthropologist carefully measures large series of people, develops objective analyses, and proposes results to be introduced into the design of all types of personal equipment or of equipment which requires accommodation of the human being, only part of his work is done. Two parts remain. He must educate the designers in his way of thinking, and then he must collaborate with the designers in setting up experiments which will convert the anthropometric requirements into terms which will be familiar to them.

The various needs for the objective consideration of bodily dimensions should be obvious, in part, to the casual observer. Beginning with clothing (Randall, 1946a), these needs extend to furniture, both for comfort and for function, automobiles, trains, aircraft, and even housing. From the viewpoint of the applied physical anthropologist a person "wears" a house, in that he gains his greatest comfort and efficiency if the house "fits" him. Tired backs at the

kitchen sink and the laundry tub can be just as painful as if they resulted from sitting in an inefficient chair. Bodily motions can be just as inefficient in a small room as they can be in tight gloves or shoes (Callaghan and Palmer, 1944). The main objective, then, in applied physical anthropology is to attain the optimum "fit" and thus the proper "size" for the human beings involved.

Obviously, in most of the problems encountered, 100 percent efficiency is not expected. The degree to which efficiency can be obtained in any one item will be dependent upon its functional characteristics of "fit" and also upon the degree of variability of dimensions which it will be required to accommodate. A secondary factor which enters the picture is the economics involved. All these factors operate to produce a compromise which is considered optimum. For example, the kitchen sink is relatively tolerant of a considerable variation in stature, but not so much as to accommodate a range of 16 inches in stature commonly encountered among housewives. On the other hand, most housewives do not operate on a strict time and motion basis, even though it would be to their advantage to do so, if they could. Finally, building houses in various "sizes" in terms of wear by the housewife is not very economical. Therefore, a compromise between accommodation, efficiency, and cost is necessary. The common compromise is a standard sink height, with the cost at a minimum and the efficiency unknown. It would not seem unreasonable to consider another possible answer; a sink provided with a height adjustment. Cost would rise somewhat, but range of accommodation and increase in efficiency would result.

It is the goal of the investigator to provide information for the designer as to the requirements of accommodation. It is the goal of the designer to meet these requirements. Finally, it is the objective of both to obtain the optimum compromise at the minimum cost.

Thus, in the field of applied physical anthropology, the physical anthropologist occupies three successive positions. Initially, he is an anthropometrist in collecting the metric data. Secondly, he is a statistician in preparing the "specifications" which describe the requirements. Finally, he is an applied physical anthropologist, analyzing the problem of the designer insofar as it relates to human bodily dimensions, and in providing for the designer, in concrete practical terms understandable to the designer, the measure of fulfillment of the requirements by the designer. Many times this last role permits the anthropologist, through his analysis, to suggest revisions in the original design which will improve its efficiency materially and often reduce its cost.

The part played by statistics in applied physical anthropology should not be underrated. It is the essential tool for converting anthropometry to engineering terms. The use made of statistical method by designers is limited at best. More often than not the concept of variability is ignored. Further the concept of accommodation of an optimum percentage (e.g., 90 percent) of a population is usually only estimated. A common design criterion is the accommodation of the "average." Two examples may serve to indicate how this is done. In the design of clothing, a new pattern is usually tested to prove its adequacy. This test is accomplished by construction of an "average" size, 36 or 38 Regular in men's garments. Revision may be necessary, but the final opinion is based upon the adequacy demonstrated by this size of garment tried on "average" men. Following this test, there are certain rules which are followed to develop the other sizes. However, experience has shown that these rules are only, at best, vaguely related to regressions which can be demonstrated by anthropometry and statistics.

In automotive design, considerable use is made of profile manikins (Randall, 1949c). These are constructed as "average men," complete with hat. If space is sufficient to accommodate this "average" man, the design is considered satisfactory. But, consider for a moment. The "average" man is about 69 inches tall and weighs about 150 pounds. Stature ranges between 61 and 77 inches, and weight between 110 and 250 pounds. Further, and apparently totally ignored, at least 33 percent of our automobiles are driven by women as well as by men. Women "average" about 64.5 inches tall and 135 pounds in weight, ranging

between 56.5 and 72.5 inches, and 90 to 200 pounds. If the automobile is to accommodate its drivers, the "average" man is too large to be "average" of drivers. Further, if the design is satisfactory for 90 per cent of its drivers, being adjustable for statures between about 61 and 70 inches, and weight between 110 and 210 pounds, it will certainly accommodate "average" drivers, and, consequently, the "average" manikin has only academic interest at best.

Situations such as those described above have been encountered so universally that there is good reason to suspect that the field of applied physical anthropology has considerable room to grow.

As of this writing at least three large and applicable series of anthropometric data have been accumulated in the United States. The first, on some 147,000 children (O'Brien and Girshik, 1939; O'Brien, Girshik, and Hunt, 1941), and the second, on about 14,700 women (O'Brien and Shelton, 1941) were collected by the Bureau of Home Economics, United States Department of Agriculture. The third, on about 135,000 Army men and 10,000 Army women represents a selected military population (Damon and Randall, 1944; Randall, 1948b). Some applications of the Department of Agriculture series have been made (Lonie, 1948; Staples and DeLury, 1949). Much wider applications of the military series have been accomplished over the past seven years. Since the Department of the Army and the Department of the Air Force are in a position to include anthropometric findings in their specifications, wide and effective applications are possible. The results can be quickly demonstrated and assessed. It is hoped that demonstrated results of the use of applied physical anthropology in the armed services will serve as stimuli to other agencies to incorporate similar approaches in their activities.

Frequently, such questions as "Why is the Army interested in physical anthropology?" or "How is the Army using physical anthropology?" are asked by laymen and even physical anthropologists as well. It is intended here to summarize present Army research in physical anthropology and to indicate some of the methods currently in use.

In some respects, it would seem that the use of physical anthropology by the military is a relatively new thing, at least in this country. The increasing use of applied physical anthropology, which is perhaps a more accurate term, is a comparatively new development. However, it is interesting to note that a book by B. A. Gould was published by the U. S. Sanitary Commission in 1869, entitled *Investigations in the military and anthropological statistics of American soldiers*, while in 1875 two volumes by J. H. Baxter were issued by the Government Printing Office under the imposing title of *Statistics, medical and anthropological, of the Provost-Marshall-General's Bureau, derived from records of the examination for military service in the Armies of the United States during the late War of the Rebellion, of over a million recruits, drafted men, substitutes, and volunteers.*

The extensive work of Davenport and Love (1921) during and following the first World War is familiar to most physical anthropologists. Measurements were obtained on 1,000,000 recruits, and also on 100,000 troops during demobilization. Although the emphasis was primarily statistical and clinical, some applications of the anthropometric data to clothing problems were carried out. Medical and clinical studies were continued through the last war under the Surgeon-General's Office, while the Selective Service System has issued several reports on medical statistics, dealing with such topics as physical examinations and causes for rejections of draftees.

As early as 1942, research in applied physical anthropology was started by the Army Air Forces. This work was carried on throughout the war, with the center of activity at the Aero-Medical Laboratory, Wright Field, Dayton, Ohio, and is being continued there. Several anthropometric surveys were carried out on flight personnel and the data obtained were used in connection with spatial requirements in aircraft and in the development of flight clothing and other types of personal equipment (Damon et al., 1944; Randall et al., 1946; Hertzberg, 1948).

After several years, the Army Quartermaster Corps carried out an anthropometric

survey in 1946. Approximately 96,000 Army separatees were processed at separation centers, while a small series of 8,500 inductees was also obtained. A series of about 9,000 women, consisting of WAC personnel and Army nurses, was measured. In conjunction with the anthropometric survey, somatotype photographs of approximately 50,000 men and 550 women were taken. This photographic material has been utilized by Hooton at Harvard University in extensive studies of body builds occurring in the Army population.

More recently, additional data have been secured in the form of smaller Army series. One year ago, a sample of 6,500 men, including draftees, enlistees and reenlistees, was measured at induction centers, while data on 2,000 marines were also obtained in 1949. Numerous smaller series of men have been measured from time to time in connection with various clothing fitting tests.

Since one of the primary responsibilities of the Office of The Quartermaster General is to clothe and equip Army men and women, applications of anthropometric data to clothing problems have received first consideration. However, there are still basic problems in the general field of human biology for which the accumulated Army anthropometric data should and can be used. Consequently, the Army program of research in physical anthropology may be considered to include both basic research and practical applications.

Obviously the human sample comprising the available Army data cannot be considered representative of the total population, since it is a selected group. There are various limiting factors, such as age, physical and medical qualifications, as well as social and economic factors. However, several types of investigation are possible with these data. One for example, is the problem of age change and terminal growth. Sufficient data are available to provide adequate series for each age from 17 through 32 years. Another problem involves the differences between military and nonmilitary populations. How do draftees or enlistees entering the Army for the first time compare with separatees who have been exposed to the military environment for various lengths of time? It is well-known that draftees, and especially 17-, 18-, or 19-year old enlistees tend to gain weight and that their body measurements change upon entering the Army. Do these changes take place rapidly within the first few weeks, do they extend over the whole period of basic training, or is it a more gradual process covering several years? These are questions of practical importance to those responsible for supplying and issuing Army clothing and equipment. Present studies utilizing the anthropometric data are focussed on these problems (Randall, 1949a).

Only preliminary reports on the Army work have been issued, since analyses of the extensive data have taken considerable time. A volume of the female data has been published, containing some 98 bivariate charts of 23 body measurements, together with 109 regression tables (Randall and Munro, 1949b).

Sorting of the male data and statistical analyses of some 37 body measurements have been completed, giving 72 bivariate charts and 83 regression tables. In addition, the male data have been sorted by age groups from 17 through 32 years, with bivariates and regression tables for each year of age. All this material is now ready for publication and will represent useful reference data.

A certain amount of sociological information is included along with the anthropometric data, such as location of birthplace, national extraction, birthplace and extraction of parents, education, civilian and military occupation, etc. Preliminary sortings on the basis of geographical area of birthplace and national extraction are now in progress.

The more recent data of a year ago are being sorted on the basis of classification—draftees, enlistees, reenlistees—as well as by age groups, for purposes of comparison with the earlier separatee and inductee material. The IBM system of punched cards and electrical sorting machines is used in all this work.

As has been mentioned previously, Army clothing has received first consideration in the applications of anthropometric data. It has been a gradual process, but marked

improvements have been and are being made in the fit of Army clothing. The old Army joke to the effect that there were only two sizes of clothing issued—too large and too small—has been disposed of.

Reduced to simplest terms, the aim of the Quartermaster Corps with respect to clothing is to fit the Army population with the best possible clothing in a minimum number of sizes, requiring the least amount of alteration. In addition, there is a further consideration which is the percentage of the population to be fitted with standard sizes. It is desirable to have this percentage as high as possible, since men outside of the range of standard sizes must be fitted with supplementary or special order sizes. These men are usually those whose body measurements fall at the upper or lower ends of the distribution curve, and who comprise the lowest percentage frequencies in the population.

Obviously, the clothing of several hundred thousand men is no small item, especially in terms of the taxpayers' dollars and cents. In this respect, it will be seen that in the proper applications of Army anthropometry with respect to clothing sizes, size systems and tariffs, significant contributions can be made, particularly in the elimination of waste resulting from incorrect sizes. The Army cannot afford the trial and error methods of the clothing industry with respect to size, nor can it afford the cost of frequent or numerous alterations.

The applications of anthropometry to clothing consist, essentially, of relating body dimensions to clothing sizes (Randall, 1948a). This procedure has necessitated a definition of the Army population in metric terms in order to obtain a measure of the ranges and variations which occur. The metric definition of the population, together with the establishment of normal distribution curves, is the most useful advance made thus far (Randall, 1949b; Randall and Munro, 1949a).

Initially, the anthropometric data were used in investigating deficiencies in the size systems of standard clothing items already in use. In several cases, this resulted in recommendations that some smaller sizes be procured, since many smaller men at the lower end of the distribution curve were not being fitted properly.

Another use of the data has been in the preparation of clothing tariffs. A tariff is a listing of the numbers of each clothing size required for the population, in terms of a given ratio, such as number per 1000, or per 100,000, as the case may be. For example, such tariffs for clothing items were prepared when the Universal Military Training program was first under consideration. Tariffs were also prepared when the recent postwar draft went into effect.

Even more profitable applications of anthropometry have been made in the development of new and improved items of clothing. In some cases it has been necessary to investigate various body measurements in order to determine just which dimensions are critical and important in the fit of clothing. It has been found that although upper body clothing, such as coats and jackets, traditionally has been sized on the basis of chest circumference, actually shoulder circumference and even waist circumference are more important than chest with respect to tolerances and fit. For example, a new system of sizing trousers on the basis of the seat dimension rather than the waist may result in a reduction of standard trouser sizes from 95 to only 30 sizes, which would be quite a saving. The sizes and tariffs for the new Air Force blue uniform were developed through the use of anthropometric data.

The applications of anthropometric data are not limited to body clothing by any means. Measurements of the head and face were used during the war in the development of gas masks, oxygen masks, goggles, and helmets (Randall and Damon, 1943). The anthropometry of the foot and the proper fit of all types of boots and shoes is a large problem in itself. A study of the hand and the functional fit of handwear has recently been initiated. It is hoped that the use of anthropometric data eventually may be extended to other types of military equipment: sleeping bags, tents, tanks, etc. The necessity for anthropometric specifications in aircraft and submarines where spatial requirements are critical is obvious.

The criticism has been made that Army

anthropometry on such a scale is unsatisfactory from the standpoint of technique. Some anthropologists even feel that as far as clothing is concerned, tailors could do just as well, and that we are wasting time and effort in attempting to apply the methods of physical anthropology to such a problem as Army clothing. The point is that clothing people are basically artists, and not human biologists, and they do not have sufficient knowledge of such topics as normal distributions of body measurements or applied statistics. Here is one field in which the trained professional anthropologist can make a practical contribution.

In closing, mention should be made of the late Francis E. Randall, who, perhaps more than any other, was responsible for the development of applied physical anthropology in the Army. He began his work with the Air Force during the war, and then came to the Quartermaster Corps in 1946 to direct the anthropometric survey. He really believed in applied physical anthropology, to the extent that had he lived, he probably would have found ways to incorporate anthropometric data in the working height of the kitchen sink or the handle of an egg-beater, not to mention automobiles or office furniture.

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GEOLOGY.—*Paleozoic of western Nevada.* H. G. FERGUSON,[1] U. S. Geological Survey.

The stratigraphic and structural history of western Nevada during the Paleozoic differs fundamentally from that of the rest of the Great Basin. In eastern and central Nevada and southern California, the Paleozoic section, at least above the Lower Cambrian, is largely limestone and dolomite. The formations, particularly those older than the Carboniferous, are fairly continuous; disconformities and unconformities are rare except at the margins of the area; and volcanic rocks are absent.

Within the western area, roughly north of lat. 37°30′ and west of an irregular line between long. 116° and 117°, there is an entirely different Paleozoic section, whose nearest lithologic similarities are with northern California and central Oregon. Quartzite, slate, and chert are the prevailing rock types, volcanic rocks are abundant, and carbonate rocks are subordinate. Crustal instability during the Paleozoic is recorded not only by unconformities and major gaps in the sections, but also by several episodes of folding and thrusting, one of which can be dated approximately as Mississippian or Pennsylvanian and another as early Permian. These were followed by major diastrophism within the Jurassic.

Further study is needed to determine whether, during early as well as late Paleozoic (Nolan, 1928), a barrier of some sort separated the two areas, as suggested by the differences in lithology, by the gaps in the sections, and by numerous disconformities and unconformities both east and west of the inferred barrier. On the other hand, lack of observed gradation between the eastern and western facies may be due to the fact that along at least a part of the border zone between the areas thrusting has carried the rocks of the western facies eastward, possibly as much as 30 or 40 miles; to the south, the western facies is separated from the eastern facies of the Panamint and Inyo Ranges by a broad belt, largely unexplored, in which the only Paleozoic rocks known are Lower Cambrian.

[1] Published by permission of the Director, U. S. Geological Survey.

The following notes on the lithology of the western Nevada Paleozoic formations are based chiefly on the results of U. S. Geological Survey reconnaissance by the writer and his associates, S. W. Muller, R. J. Roberts, and S. H. Cathcart. The area covered consists of three one-degree quadrangles: the Sonoma Range quadrangle, lat. 40°–41°, long. 117–118°, comprising four 30 - minute quadrangles — Winnemucca (Ferguson, Muller, and Roberts, 1951); Mount Tobin (Muller, Ferguson, and Roberts, 1951); Golconda (Ferguson, Roberts, and Muller, in press); and Mount Moses (Ferguson, Muller, and Roberts, 1951); and the Hawthorne and Tonopah quadrangles, lat. 38–39°, long. 117–119° (Ferguson and Muller, 1949). In addition to the reconnaisance studies, more detailed mapping was done by Roberts in the Antler Peak 15-minute quadrangle (Roberts, 1951) in the northeastern part of the Sonoma Range quadrangle. Mapping by James Gilluly is in progress in three 15-minute quadrangles (Mount Lewis, Crescent Valley, and Cortez), east of the southern part of the Sonoma Range quadrangle, and by Preston E. Hotz in the Osgood Mountain quadrangle to the north. A vast area remains unexplored, and much additional field work is needed.

Cambrian.—In the Hawthorne and Tonopah quadrangles, the fossiliferous Lower Cambrian rocks are largely quartzite and slate, with subordinate dolomite and limestone. No Middle or Upper Cambrian has been identified, though Upper Cambrian has been reported by Turner (1902) in the Silver Peak quadrangle to the south. These rocks are overlain apparently conformably by Ordovician rocks of the western facies (Ferguson and Muller, 1949, pp. 45–52). In the Sonoma Range quadrangle thick unfossiliferous quartzite, presumably of Lower Cambrian age, is overlain by several thousand feet of slate with minor amounts of dolomite and limestone of Upper or Middle Cambrian age (Ferguson, Roberts, and Muller, in press). These show no lithologic similarity to the better-known dominantly carbonate formations in the ranges to the east.

Ordovician.—Ordovician rocks are present in great thickness and variety throughout the entire western area. In the Tonopah and Hawthorne quadrangles (Ferguson and Muller, 1949) they consist largely of dark cherts, graptolite-bearing slates, and quartzites. In the Sonoma Range quadrangle and neighboring quadrangles to the east, there are also andesitic lavas and breccias (Roberts, 1951; Ferguson, Muller, and Roberts, in press). The proportions of the various rocks vary greatly in different areas. Carbonate rocks, which form most of the section in central and eastern Nevada, are scarce.

Along the eastern border of the area, a thrust has superposed the slaty rocks of the western facies Ordovician above the carbonate eastern facies. The western facies of the upper plate is known to extend as far to the east as the Sulphur Spring Mountains, about lat. 39°45′, long. 116°05′ (Merriam and Anderson, 1942). The same thrust relations of the two facies are also present in the Cortez quadrangle, lat. 40°10′, long. 116°40′ (Gilluly, personal communication). It is possible that a thrust contact is also present to the southward, for at Belmont, about lat. 38°35′, long. 116°55′, the Ordovician consists of characteristic western facies with graptolite-bearing slate (Ferguson, 1924, p. 23), while the eastern facies, including the Pogonip limestone and Eureka quartzite, is present at Tybo, 30 miles southeast (Ferguson, 1933, pp. 16–20). The western facies is known to extend southward as far as the southern border of the Silver Peak quadrangle, lat. 37°30′ (Turner, 1902). Fifty miles to the south, at the northern end of the Panamint Range, are the characteristic carbonate rocks and Eureka quartzite of the eastern facies (McAllister, 1947). In the largely unexplored region between these two areas the only known Paleozoic rocks are of Cambrian age.

Silurian.—No rocks of Silurian age have yet been found in the western area, although thick Silurian formations of carbonate rocks are known along its eastern border, as far west as long. 116°50′. The westernmost sections include shaly limestones carrying graptolites (Kirk, 1933, p. 34; Gilluly, personal communication).

Devonian.—Devonian is known at two localities in the western area; in the San Antonio Mountains about 8 miles north of Tonopah (about lat. 37°10′, long. 117°10′) and in the northeastern part of the Mount Lewis quadrangle (near lat. 40°30′, long. 116°45′).

The Devonian of the San Antonio Mountains consists of about 1,000 feet of limestone containing a fauna referred to Middle Devonian. This rests with a small angular unconformity on the characteristic Ordovician chert and slate of the western facies, although the lithology and fauna suggest correlation with Devonian carbonate formations to the east.

In the Mount Lewis quadrangle (Gilluly, personal communication) the Devonian is entirely different in lithology and consists of about 4,000 feet of dark chert and sandstone with subordinate slate, and a few thin beds of limestone which have yielded identifiable fossils. No volcanic rocks are present. The formation is in thrust contact with the Ordovician of the western facies and its relation to other formations is unknown. Except for the absence of volcanic rocks, the lithology is similar to that of parts of rocks mapped as Pennsylvanian (?) in the Sonoma Range quadrangle (Pumpernickel formation) and it is possible that more detailed study will show that Devonian is also present in the Sonoma Range quadrangle.

Carboniferous.—No formations of Carboniferous age are present in the Hawthorne and Tonopah quadrangles, where Permian rocks rest unconformably on highly folded Ordovician slate and chert. In the Sonoma Range quadrangle, however, there is a puzzling complex of formations of probable Mississippian and known Pennsylvanian age (Roberts, 1951). A great thrust, the Golconda thrust (Ferguson, Roberts, and Muller, in press), probably of Jurassic age, brings together completely different Carboniferous and Permian formations. Further complexity is caused by thrusting within both plates during at least two periods; in late Mississippian or early Pennsylvanian in the lower plate, and within the Permian in the upper plate.

Below the thrust, there are two formations of probable Mississippian age. These are themselves in thrust contact, and both are overlain by lower Pennsylvanian conglomerate. The Scott Canyon formation (Roberts 1951), present only in the eastern part of the Antler Peak quadrangle, consists of andesitic meta-volcanic rocks and chert, with some argillite. A thin bed of limestone yielded fossil sponges, considered to be not older than Carboniferous (Helen Duncan, personal communication).

The Harmony formation is unfossiliferous and consists essentially of micaceous arkosic grit and micaceous quartzite that locally attain a considerable thickness. Derivation from a granitic

or gneissic land mass to the west, perhaps in the area now occupied by the Sierra Nevada batholith, seems to be implied. Probable persistence of such a land mass throughout most of late Paleozoic time is suggested by recurrence of beds of similar arkosic material in the Pennsylvanian and Permian clastic formations of the area.

The Battle formation, consisting of conglomerate and pebbly limestone of lower Pennsylvanian age (Roberts, 1951), was deposited across the thrust contact of the Scott Canyon and Harmony formations. No correlation with formations in the east has yet been established.

Disconformably above the Battle formation is the Antler Peak limestone of upper Pennsylvanian and possibly lower Permian (?) age (Roberts, 1951). The fauna of the limestone, according to J. S. Williams (personal communication), resembles Alaskan and Russian species. At present this limestone is known only in the northeastern part of the Sonoma Range quadrangle and the Osgood Mountain quadrangle to the north (Hobbs, 1948).

In the upper plate of the Golconda thrust, the thick Pumpernickel formation, largely andesitic volcanics, chert, and argillite, is tentatively assigned to the Pennsylvanian, as it is overlain conformably by sedimentary formations of lower Permian (?) age (Roberts, 1951; Muller, Ferguson, and Roberts, 1951). This formation has not yet been traced outside the Sonoma Range quadrangle, but it is probably present in the Osgood Mountain quadrangle to the north (Hobbs, 1948).

Permian.—Permian rocks of the Sonoma Range quadrangle (Roberts, 1949, 1950; Ferguson, Roberts, and Muller, 1951) also differ on the two plates of the Golconda thrust. Below the thrust the Edna Mountain formation, consisting primarily of quartzite, in part micaceous, conglomerate, limestone, and slate, rests disconformably on the Pennsylvanian and Permian (?) limestone. This formation contains the same fauna as the well-known Phosphoria formation of the eastern part of the Great Basin and may represent a clastic marginal facies.

The upper plate of the thrust carries two formations not found in contact, but both overlie conformably a thick sequence of dominantly metavolcanic rocks assigned to the Pennsylvanian. In the central part of the Sonoma Range quadrangle the Havallah formation is 10,000 feet or more thick and consists of quartzite carrying feldspar in part, with interbedded chert, subordinate slate, and thin limestone beds. Near the base of the formation the limestone contains fusulinids of Wolfcamp and probably Leonard age (Roberts, 1951). Along the western edge of the quadrangle and tentatively correlated with the Havallah formation, is the Leach formation containing a larger proportion of coarser clastics including conglomerate, graywacke, impure quartzite in part arkosic, together with slate and a little limestone in the upper part (Muller, Ferguson, and Roberts, 1951). No determinable fossils were obtained from these, and a thrust separates them from the more quartzitic Havallah formation of the central part of the quadrangle. It seems a reasonable inference that it may be merely a more coarsely clastic facies. If so, a western source for both formations is implied.

Folding, accompanied by some thrusting and followed by deep erosion, preceded the youngest Permian unit of the Sonoma Range quadrangle, the dominantly volcanic Koipato formation. This differs from the older volcanic formations in that the lavas are in part silicic, and are less metamorphosed. The Koipato formation overlies the Permian (?) of the upper plate facies with marked angular unconformity and is overlain unconformably by Triassic rocks, but with angular discordance of only a few degrees at most. Its greatest known thickness, 14,000 feet (Knopf, 1924; Wheeler, 1939), is a few miles west of the Sonoma Range quadrangle, but within the quadrangle it thins out completely to the east (Ferguson, Roberts, and Muller, in press). It is known, however, to extend some distance to the south and southwest. It has not been found below the Golconda thrust, so its relation to the Permian sedimentary rocks with Phosphoria fossils is not determinable in the Sonoma Range quadrangle.

In the Tonopah and Hawthorne quadrangles, the Permian sedimentary rocks containing the Phosphoria fauna lie unconformably on folded Ordovician rocks (Ferguson and Muller, 1949, pp. 45–52). In the southern part of the area these sedimentary rocks consist of 400 feet or less of grit and quartzite that locally grade laterally into dolomite. The formation is disconformably overlain by Lower Triassic and locally the Permian was completely eroded before Triassic deposition.

In contrast to the thin Permian of the south, the Toyabe Range in the northeast part of the Tonopah quadrangle contains a thickness of

about 6,000 feet of sedimentary and volcanic rocks assigned to the Permian, though fossiliferous only in the lower part. The upper part of the sequence is principally chert and metaandesite with interbedded sedimentary rocks similar to those of the lower part. Fine-grained silicic intrusive rocks similar in composition to the lavas of the Koipato formation cut these rocks, but were not found in areas underlain by Triassic rocks. It is therefore possible that the Koipato formation may be somewhat younger than the sedimentary rocks containing Phosphoria fossils.

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PALEONTOLOGY.—*Some new species of crinoids from the Henryhouse formation of Oklahoma.*[1]

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This paper is the first of a series to be devoted to echinoderms of Silurian age. The genera dealt with are *Allocrinus, Zophocrinus, Gnorimocrinus, Bactrocrinites, Hexacrinites,* and *Synbathocrinus*. All except the last three are known from rocks of Brownsport age; however, the species from the Henryhouse exhibit some decided, and probably significant, variances from the norm of the genera involved. The last three genera are not reported elsewhere from strata of Silurian age but are found in rocks of Devonian age.

Genus **Hexacrinites** Austin and Austin, 1843

Hexacrinites adaensis, n. sp.

Figs. 4, 5

Dorsal cup is somewhat elongate bell-shaped. The lateral sides rise evenly above the columnar

[1] Numerous individuals have contributed directly or indirectly to this study. Dr. G. A. Cooper, Dr. A. R. Loeblich, Jr., and Arthur Bowsher, of the U. S. National Museum, and Dr. W. E. Ham, of the Oklahoma Geological Survey, have directed the author in field studies and/or have lent specimens for description and comparison. Dr. Edwin Kirk, of the U. S. Geological Survey, Dr. R. S. Bassler, of the U. S. National Museum (retired), Dr. Hertha Sieverts-Doreck, of Stuttgart, Germany, and Dr. G. Ubaghs, of Liége, Belgium, have assisted in taxonomic and technical problems. Richard and Russell Alexander, at present students at the University of Oklahoma, William T. Watkins, of San Antonio, Tex., and Mr. and Mrs. Allen Graffham, of Purcell, Okla., have assisted considerably in field work and through contribution of many fine specimens. The author's wife, Mrs. Melba Strimple, has found many splendid specimens in both the Henryhouse of Oklahoma and the Brownsport of Tennessee.

attachment, then expand rapidly for a short distance, after which further expansion is gradual. There are three unequal BB, the smallest right posterior in position. Slightly over half the cup height is composed of the elongated RR and anal X. The five RR have small arm articulating facets, which are directed outwardly. The single anal plate is comparable in size to the r. post. R, and both are smaller than other RR.

Columnar cicatrix is round. Arms and tegmen are unknown.

Measurements in mm.—As follows:

Height of dorsal cup	13.0
Maximum width of cup	12.0*
Height of BB circlet (maximum)	6.9
Diameter of columnar scar	3.0

* Mildly distorted by lateral compression.

Remarks.—*H. adaensis* is the only representative of the genus reported at present from rocks of Silurian age. The distinctive contour of the cup is sufficient to distinguish the species from other described forms.

Holotype.—Collected by the author. To be deposited in the U. S. National Museum.

Occurrence and horizon.—SW1/4NW1/4NW 1/4 sec. 33, T. 3 N., R. 6 E., south of Ada, Pontotoc County, Okla.; Henryhouse formation (upper), Silurian.

Genus **Synbathocrinus** Phillips, 1836

Synbathocrinus antiquus, n. sp.

Figs. 1-3

Dorsal cup is elongated and narrow until the distal extremity is approached, at which point there is a strong, outwardly directed flexing. There are three erect BB, the smaller in left anterior position. Five RR are of equal size and are very elongated. A well-developed notch is present between r. post. and l. post. BB for reception of an anal plate. This groove continues into the interarticulating areas. Arm articulating facets are distinctive; the outer ligamental furrow is very thin and is bordered to the exterior by a well-crenulated lip and to the interior by a slight ridge; muscle areas are shallowly depressed and thereafter the facets curve strongly upward so that a domelike structure is formed, almost covering the body cavity. In the uplifted area, a narrow slit divides each facet into two equal parts. Unless carefully examined, the domelike structure has the appearance of an oral circlet.

PBrBr are quadrangular, slightly wider than high. The proximal columnal is round, thick and expanded in midsection. A minute, pentalobate lumen pierces the column.

Measurements in mm.—As follows:

	Holotype
Height of dorsal cup	9.4
Maximum width of cup	7.6
Height of BB circlet	3.7
Width of BB circlet	3.7
Diameter of proximal columnal	2.2

Remarks.—The unique appearance of *S. antiquus* is not closely approached by any other described species, and no other representative of the genus is recorded from Silurian strata.

Types.—Holotype collected by William T. Watkins, one paratype collected by Richard Alexander and one by the author. To be deposited in the U. S. National Museum.

Occurrence and horizon.—Near center of sec. 4, T. 2 N., R. 6 E., south of Ada, Pontotoc County, Okla., the type locality. Paratypes from SW1/4 NW1/4NW1/4 sec. 33, T. 2 N., R 6 E., Pontotoc County; Henryhouse formation (upper), Silurian.

Genus **Zophocrinus** S. A. Miller, 1892

Zophocrinus angulatus, n. sp.

Figs. 6, 7

Dorsal cup is elongated and angular. There are four lateral sides marked by sharp longitudinal ridges. A horizontal ridge about 0.4 mm below the summit marks the termination of the cup angulation and the uppermost portion is circular in outline. In the proximal region is a slight twisting which causes inequality in the width of facets and there is a wafer-thin ridge marking the lowermost edge of the cup. Viewing the cup from below, there is an almost triangular outline. Three BB form almost half the length of the cup and four RR the balance. Arm articulating facets have not been observed in any of the specimens at hand. Sutures of the cup are not impressed. Proximal columnal is round, thin and small.

Measurements in mm.—As follows:

	Holotype	*Paratype*
Height of dorsal cup	9.3	10.3
Maximum width of cup	5.5	5.6
Height of BB circlet	4.5	4.7
Maximum width of BB circlet	4.7	5.1
Diameter of stem attachment	1.1	1.4

Remarks.—The strong angulation characteristic of *Z. angulatus* is sufficient to distinguish it from other described species.

Types.—Holotype collected by the author. Paratype collected by Richard Alexander. To be deposited in the U. S. National Museum.

Occurrence and horizon.—Center SW1/4NW 1/4 sec. 33, T. 3. N., R. 6 E., south of Ada, Pontotoc County, Okla.; Henryhouse formation (upper), Silurian.

FIGS. 1–3.—Holotype of *Synbathocrinus antiquus*, n. sp., from posterior, anterior, and summit, × 3.6. FIGS. 4–5.—Holotype of *Hexacrinites adaensis*, n. sp., from left anterior and posterior, × 1.8. FIGS. 6–7.—Holotype of *Zophocrinus angulatus*, n. sp., side view of dorsal cup and opposite side, × 3. FIGS. 8–9.—Holotype of *Allocrinus divergens*, n. sp., side view of crown and opposite side, × 1.7. FIGS. 10–11.—Holotype of *Gnorimocrinus pontotocensis*, n. sp., from base and summit, × 5.8. FIGS. 12–13.—Holotype of *Bactrocrinites oklahomaensis*, n. sp., from right posterior and posterior, × 1.5.

Genus **Bactrocrinites** Schnur, 1849

Bactrocrinites oklahomaensis, n. sp.
Figs. 12, 13

Dorsal cup is very long, slender, expanding evenly from the columnar attachment. Five slender IBB form almost half the cup height. Five BB are normal hexagonal plates except for the posterior and right posterior RR which are truncated for the reception of the two anal plates. Five RR are relatively wide plates with small, outwardly directed arm articulating facets. R. post. R. is smaller than others and is extended above the normal cup height. Ant. R is the largest plate of the circlet. RA is small, quadrangular and rests obliquely on the left shoulder of r. post. B and the right shoulder of post. B. Anal X is large, hexagonal and rests obliquely on post. B and RA to the right below. Arm articulating facets show no evidence of muscular fossae but have rather deep intermuscular notches which extend well into the body cavity.

Measurements in mm.—As follows:

Height of dorsal cup (anterior)	22.3
Maximum width of cup	12.0
Height of IBB circlet	11.2
Maximum width of IBB circlet	7.8
Diameter of columnar scar	2.7

Remarks.—*B. oklahomaensis* has a more elongated calyx, especially as reflected by the IBB portion, than any other described species. It is the only representative of the genus reported from rocks of Silurian age.

Holotype.—Collected by the author. To be deposited in the U. S. National Museum.

Occurrence and horizon.—NW1/4NW1/4SW 1/4 sec. 4, T. 3 N., R. 6 E., south of Ada, Pontotoc County, Okla.; Henryhouse formation, Silurian.

Genus **Gnorimocrinus** Wachsmuth and Springer, 1880

Gnorimocrinus pontotocensis, n. sp.
Figs. 10, 11

Dorsal cup shallowly expanded. IBB are three, almost entirely covered by the shallowly depressed, round columnar cicatrix. BB are five 6-sided plates with pentagonal outlines, except for post. B, which is strongly encroached upon by the hexagonal RA, and is extended inwardly toward the body cavity. RR are five rather elongated, pentagonal plates. Interradial areas are deeply impressed. Anal X is a large plate and is followed by a tubelike series of plates which curve inwardly. The entire body cavity appears to be covered by tegmenal and minute ambulacral plates. Five rather large plates alternate with the RR, and that of the posterior carries a small node, which may mark a hydropore. First PBrBr are only preserved in the right and left posterior rays. The l. post. PBr is axillary and the r. post. PBr is nonaxillary. Both are rather short plates.

Measurements in mm.—As follows:

Height of dorsal cup	3.1
Maximum width of cup	7.0
Diameter of stem scar	1.7

Remarks.—Other described species normally disclose arm branching with the second primibrachials in all rays and the RA is quadrangular, not in contact with the IBB circlet. In *G. pontotocensis* the first PBr of the l. post. ramus is axillary and RA is hexagonal owing to contact with the IBB circlet.

Holotype.—Collected by A. R. Loeblich, Jr. Deposited in the U. S. National Museum.

Occurrence and horizon.—SW1/4NW1/4NW 1/4 sec. 33, T. 3 N., R. 6 E., Pontotoc County, Okla.; Henryhouse formation, Silurian.

Genus **Allocrinus** Wachsmuth and Springer, 1889

Allocrinus divergens, n. sp.
Figs. 8, 9

Crown is elongate, expansive. Dorsal cup is proportionately quite small. The BB plates are displaced and are not sufficiently well preserved for accurate observation. Considering the attitude and structure of the RR, there is little likelihood that the base of the cup was particularly broad or invaginated, as is considered typical of the genus. Five RR are moderately large. The proximal portions are not curved under but the lateral sides are curved mildly inwardly and the depressions continue into the interbrachial region. Arm articulating facets do not fill the distal faces of RR and the junctures with PBrBr are not well defined. PBrBr are low, triangular shaped axillary plates, one to each ray. Succeeding SBrBr are low wide plates and are multiple pinnular.

One IBr is known to be present in one interray. The column is small and round. Tegmen is unknown.

Measurements in mm.—As follows:

Length of crown	37.2
Height of dorsal cup	2.8
Diameter of proximal columnal	1.8
Length of RR (to PBrBr)	2.8
Maximum width of RR	3.9

Remarks.—In general appearance this species is obviously a member of *Allocrinus*, but certain

characteristics are not typical of the genus. In other known species there is a small quadrangular PBr in each ray followed by a larger pentagonal PBr which is axillary. The first PBr in each ray of *A. divergens* is low, triangular and axillary. The proximal extremities of RR are curved under to form part of a broad basal area in other species. *A. longidactylus* Springer (1926) displays arms, which are very similar to those of the present species except for the number of primibrachials.

Holotype.—Collected by Richard Alexander. To be deposited in the U. S. National Museum.

Occurrence and horizon.—NW1/4SW1/4 sec. 4, T. 2 N., R. 6 E., south of Ada, Pontotoc County, Okla.; Henryhouse formation (upper), Silurian.

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All cited references are to be found in Bassler and Moody, *Bibliographic and faunal index of Paleozoic Pelmatozoan Echinoderms*. Geol. Soc. Amer. Spec. Pap. 45. 1943.

PALEONTOLOGY.—Cribrotextularia, *a new foraminiferal genus from the Eocene of Florida*. ALFRED R. LOEBLICH, JR., and HELEN TAPPAN, U. S. National Museum.

In a search for topotype specimens of genotype species, for study in a generic revision of the Foraminifera, the writers found specimens of a textularian form with a cribrate aperture in middle Eocene material from Florida. Comparison with the types showed it to be the species *Textularia coryensis* Cole. The species was described by Cole (1941, p. 21) as having an "aperture broad, low, indistinct."

A thorough rewashing of topotype material including prolonged boiling, made possible the determination of the true apertural characters which were obscured in the holotype by adhering limy material. The cribrate aperture thus revealed is reminiscent of the upper Paleozoic foraminiferal genus *Cribrostomum* Möller, and affords an interesting example of convergence in development between these two stratigraphically distant genera.

Although Cushman (1948) defines *Cribrostomum* as "test free, biserial; wall finely arenaceous, thick, with an outer thin layer; apertures of the early stages textularian, later cribrate, on the terminal face of the chamber," he also noted that it "may be only a stage in the development of *Climacammina*." This latter genus he describes as "test free, early portion biserial, later uniserial; wall arenaceous, mostly of fine fragments but including coarser ones, cement calcareous; aperture in the biserial portion textularian, in the uniserial portion irregularly cribrate, terminal." Thus he distinguished these genera as *Cribrostomum* being wholly biserial and *Climacammina* biserial to uniserial. Möller (1879) did not exclude bigenerine forms and in fact described *Cribrostomum bradyi*, *C. commune*, *C. elegans*, *C. gracile*, *C. pyriforme*, and *C. textulariforme*, of which only the first and last "species" were illustrated as completely biserial. Möller did not designate a genotype, but included four bigenerine forms to only two of the textularian forms. The genotype was selected by Cushman (1928, p. 120) as *Cribrostomum textulariforme*. However, all of Möller's species are surprisingly alike in size, ornamentation and other characters and it seems unlikely that six true "species" would occur in such a limited horizon, all very close in appearance and with similar geographic ranges. In fact, as was stated by Plummer (1945, p. 244) "The designated genotype [*C. textulariforme*] is without doubt the immature form of one of the five biformed species in the group of eight "species" recorded in the same paper with the description of *Cribrostomum*. *C. commune* Möller is recorded from the same localities as *C. textulariforme* and can well be the mature form of the species."

Other writers have also included biformed species under *Cribrostomum* including Lee and Chen (1930, pp. 96–102), Harlton (1927, p. 22) and Plummer (1945, p. 245). This genus might thus be considered synonomous with *Climacammina* H. B. Brady, 1873. However, they may be distinguished by apertural characters as was brought out by Plummer (1945, pp. 244, 245), who stated that "... symmetry in arrangement and in shape of the large and

comparatively few openings throughout the uniserial stage is a consistent feature that distinguishes the group represented by Brady's genotype of *Climacammina* from Möller's genotype of *Cribrostomum*."

Cribrostomum in the adult thus has a multiple aperture of irregularly shaped pores scattered over the terminal area with no definite pattern, whereas *Climacammina* has symmetrical pores both in shape and arrangement. A similar form, *Deckerella* Cushman and Waters, was described as like *Climacammina*, but with only two terminal pores. This "genus" is only a growth stage of *Climacammina* and the genotype species itself may have a multiple aperture of at least four openings.

Cushman regarded both *Cribrostomum* and *Climacammina* as having an arenaceous wall with calcareous cement. Galloway (1933, pp. 223, 224) stated that both are calcareous, consisting of an "inner, hyaline, fibrous or porous layer and outer darker, very fine granular or structureless layer which is neither arenaceous nor composed of agglutinated particles but is partially a network of cryptocrystalline silica, the major portion being calcite; surface of test rough, giving an arenaceous appearance." Galloway used this type of wall structure as the basis for a new subfamily, the Palaeotextulariinae. Lee and Chen (1930, p. 100) in describing *Cribrostomum longissimoides* state "Wall composite, with a relatively thin and smooth inner layer and much thicker and coarser outer layer of arenaceous nature." Plummer (1945) corroborated these observations stating "The calcareous shell wall is almost wholly fibrous with an external coating of irregular calcareous particles or granules, so that the surface is pebbled, though composed of no adventitious matter." Plummer also noted that "the cribrate surface of chambers in the late biserial stage and throughout the uniserial stage is supported and strengthened by

FIGS. 1-5.—*Cribrotextularia coryensis* (Cole): 1, Top view of hypotype (USNM P. 67a), with final chamber broken to show slit aperture of previous chamber and supplementary apertures; 2, 4, top views of additional hypotypes (USNM P. 67 b, c) showing multiple apertures; 3*a*, side view of hypotype (USNM P. 67d) showing biserial chamber arrangement; 3*b*, top view, showing ring of apertures; 5, top view of hypotype (USNM P. 67e) with broken final chamber with part of ring of apertures visible and also showing multiple apertures of preceding chamber where final chamber is broken away. (All figures × 33.)

irregularly developed walls and pillars that tie the terminal wall to the last septum, thus making the chamber labyrinthic."

The following brief description summarizes the characters of the new genus:

Family TEXTULARIIDAE

Cribrotextularia Loeblich and Tappan, n. gen.

Genotype: *Textularia coryensis* Cole. Middle Eocene of Florida.

Diagnosis.—Test free, quadrate in section; chambers biserially arranged throughout; wall arenaceous, simple in construction, not labyrinthic; aperture in early stages consisting of an arch at the base of the last chamber and in addition a symmetrical series of pores, usually in a ring, on the face of the chamber, arched aperture partially closed in later chambers and represented by a series of openings at the base of the final chamber in addition to the terminal cribrate apertures.

Remarks.—The present genus differs from both *Climacammina* and *Cribrostomum* in being wholly biserial, and in lacking any uniserial development, in being quadrate rather than oval in section, in lacking surface ornamentation, in having a simple and distinctly arenaceous wall, and not a double-layered fibrous calcareous one, and in lacking any development of pillars supporting the terminal chamber as was found in *Cribrostomum* by Plummer. It further differs from *Cribrostomum* in having a ring of symmetrically arranged rounded pores as the cribrate aperture, rather than irregularly shaped and spaced openings, and in this respect is more like *Climacammina*. However, the cribrate aperture is visible only on the final chamber, while all the pores on earlier chambers are covered by the wall of the succeeding chamber. On biserial specimens of *Cribrostomum marblense* Plummer, the cribrate aperture is visible on both chambers of the last pair.

Cribrotextularia coryensis (Cole)

Figs. 1–5

Textularia coryensis Cole, Florida Geol. Surv. Bull. 19: 21, pl. 1, fig. 13. 1941.

Test free, large, robust, triangular in side view, quadrate in section; chambers numerous, biserially arranged, increasing gradually in height and breadth as added, slightly inflated; sutures distinct, depressed, nearly straight, slightly oblique; wall agglutinated, with distinct calcareous fragments in a granular ground mass, surface irregular; aperture in the early stages consisting of an elongate slit at the base of the final chamber, which becomes progressively closed in later chambers with the simultaneous development of a terminal cribrate aperture of about four or five regularly spaced openings, the complete slitlike aperture has not been observed on the final chamber of any specimen, although it can be seen in the penultimate chamber of one of the hypotypes (Fig. 1), the final chamber has only a few residual pores representing the slit aperture, and a better development of the terminal cribrate aperture.

Length of figured hypotype (Fig. 3) 1.77 mm, greatest breadth 0.94 mm, thickness 0.73 mm. Other specimens are from 1.51 to 2.29 mm in length.

Types and occurrence.—Holotype and unfigured paratypes (Florida Geological Survey collections, S-1533 and S-1533A) and unfigured hypotypes also in Florida Geological Survey Collections (S-3330), figured hypotypes (USNM P. 67, a–e) all from the middle Eocene at 1,360–1,370 feet in the Peninsular Oil and Refining Co. Cory No. 1, in sec. 6, T.55S., R. 34E., Monroe County, Fla.

Acknowledgements.—The writers are indebted to Dr. Herman Gunter, director of the Florida Geological Survey, for use of topotype material and also for the loan of Cole's type specimens. The illustrations are camera-lucida drawings made by Mrs. Sally D. Lee, scientific illustrator, Smithsonian Institution.

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ZOOLOGY.—Ammopemphix, *new name for the Recent foraminiferal genus* Urnula *Wiesner*. ALFRED R. LOEBLICH, JR., U. S. National Museum.

The name *Urnula* proposed by Wiesner (Deutsche Südpolar-Exped. **20:** Zool.: 82. 1931) for a Recent Antarctic foraminiferal genus is preoccupied by the protozoan *Urnula* Claparède and Lachmann (Ann. Sci. Nat., Paris, Zool. ser. 4: **8:** 235. 1857). The name *Ammopemphix* is here proposed to replace the name *Urnula* Wiesner. The genotype (type species) is *Urnula quadruplo* Wiesner, 1931.

ZOOLOGY.—*A new* Calyptrophora (*Coelenterata: Octocorallia*) *from the Philippine Islands.*[1] FREDERICK M. BAYER, U. S. National Museum.

Among the unidentified primnoïd octocorals of the U. S. National Museum which have been examined in connection with studies on the Gorgonacea of the Indo-Pacific region, there is a single branch of a remarkable species of *Calyptrophora*. Its zooids are so distinctly different in armature from those of any previously described species that I feel justified in describing it as new even without knowledge of the appearance of the entire colony.

It is with a deep sense of appreciation that I name this species in honor of Dr. Julia A. Gardner, of the U. S. Geological Survey.

Genus **Calyptrophora** Gray

Calyptrophora J. E. Gray, 1866, p. 25; Kükenthal, 1924, p. 317.

Calyptrophora juliae, n. sp.

Diagnosis.—Zooids about 1.75 mm high, facing upward, in whorls of 4–6; 15 whorls in 3 cm of axis length; both scale pairs inseparably fused in ring form; basal ring with two stout diverging spines 1.5 mm long; buccal ring margin with 2–4 short, triangular processes; opercular not laciniated apically; rind scales without external crests; tentacles with minute flat scales.

Description.—The type specimen is a single terminal branch about 12 cm long, which bears closely set whorls of distally directed zooids throughout its length except for the proximal 5 mm, where the axis is bare. The axis is distinctly flattened, at least in this branch, longitudinally grooved and of a metallic gold sheen with bright green iridescence. Fifteen zooid whorls (Fig. 1, *f*) occur in 3 cm of axial length; the apical whorl contains four zooids, while those lower down on the branch ordinarily are made up of five or six. The zooids (Fig. 1, *e*, *k*) are surrounded by two pairs of body scales, basal and buccal, as is characteristic of the genus. The members of both sclerite pairs are completely united and inseparably fused to form a pair or rings which encircle the zooid body. The basal ring (Fig. 1, *h*) is unusually thick and heavy, and bears a single pair of strong, tapered, diverging spines. These are very stout and nearly round, and are longitudinally sculptured with fine, wavy striae which are minutely prickly, especially toward the tips of the spines. The spines are about 1.5 mm long (1.25–1.75 mm) and about 0.35 mm thick at the base. The body of the ring is externally finely granular, the granules so arranged as to form a closely reticulate pattern. The total length of the basal ring including the spines is about 2.75–3.00 mm. The buccal ring (Fig. 1, *g*) is stout but not so heavy as the basal. It expands somewhat distally, but is not flared, and there is only a very slighty projecting margin which bears one or two pairs of short, triangular processes. The length of the buccal ring along the abaxial suture is about 1.25 mm; its diameter at the oral aperture about 1 mm. There is a well-developed operculum of eight roughly triangular scales 0.4 to 0.6 mm high (Fig. 1, *a–d*). Each bears a prominent longitudinal ridge on its inner face, and even the largest show no tendency toward laciniation of the apex. The tentacles contain small, elongate, irregular-margined scales (Fig. 1, *i*) about 0.1 mm long. Ordinarily there is but a single pair of curved infrabasal plates lying between the basal scale ring and the plates of the coenenchyma, but one or both may be transversely divided into two short plates, so that there sometimes appears to be an extra infrabasal scale or pair of scales. The infrabasals

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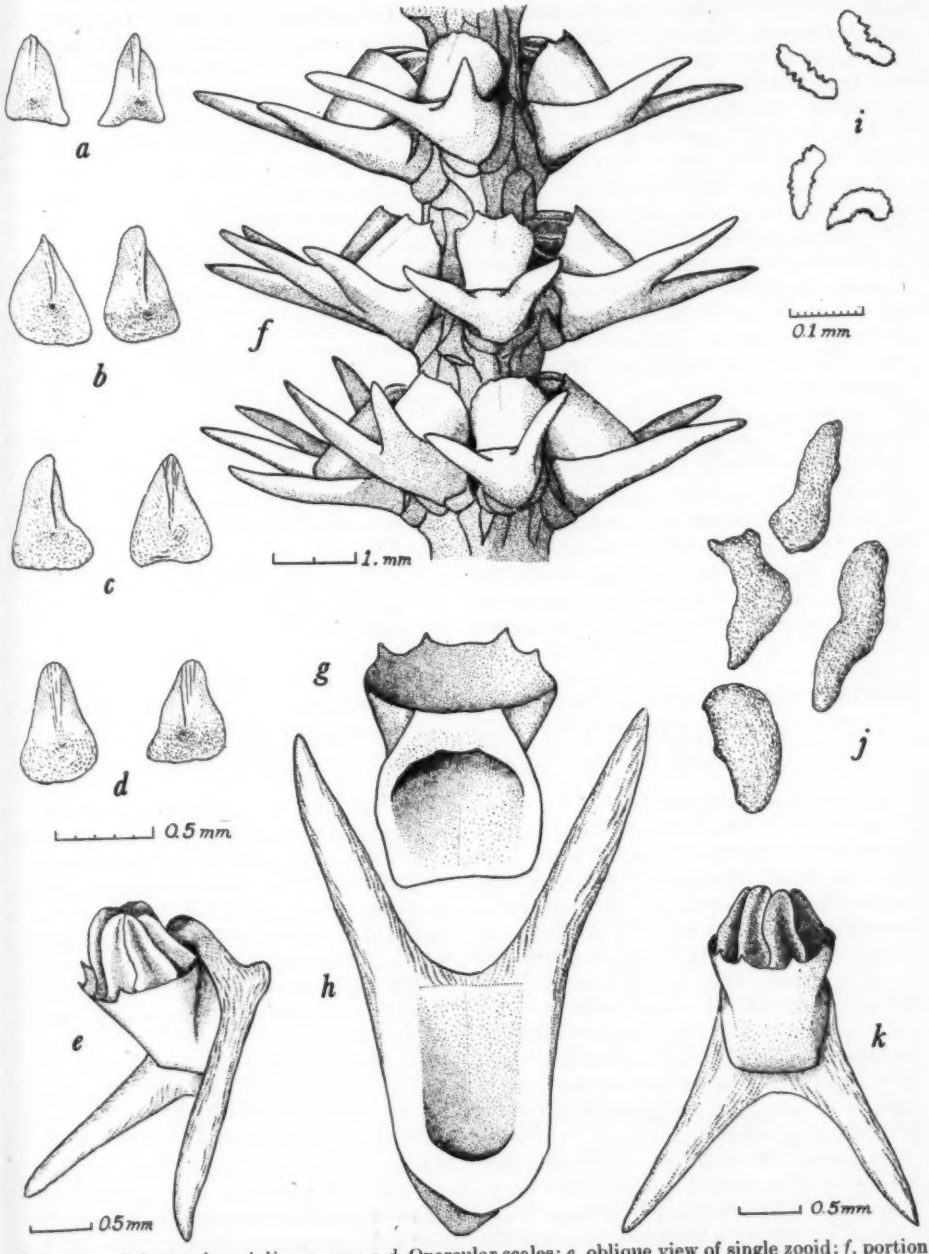

FIG. 1.—*Calyptrophora juliae*, n. sp.: *a-d*, Opercular scales; *e*, oblique view of single zooid; *f*, portion of branch with three whorls of zooids; *g*, buccal scale ring seen from adaxial side; *h*, basal scale ring from above; *i*, scales from the tentacles; *j*, plates from the coenenchyma; *k*, abaxial view of zooid. (Magnifications: 0.5 mm scale at *d* applies to *a-d*, *g*, *h*, *j*, *k*; 0.5 mm scales at *e* and *k* apply to those figures only; 1.0 mm scale at *f*, and 0.1 mm scale at *i*, apply to those figures only.)

form a semicircular collar which partially surrounds the base of the zooids. The rind sclerites (Fig. 1, *j*) are flat, irregular, granular plates without strong external keels or ridges. All of the large sclerites are translucent, milky white.

Type.—U.S.N.M. no. 49814. *Albatross* station 5119, Philippine Islands: Verde Island Passage, between Lubang Island and Cape Santiago, Luzon, (13° 45′ 05″ N., 120° 30′ 30″ E.) 394 fathoms, sand and green mud; January 21, 1908.

Remarks.—While the over-all character of branching is unknown, there is a possibility that the entire colony has the lyrate form which occurs in various species of *Calyptrophora* (*cf.* Kinoshita, 1908, pl. 4, figs. 33, 35; and Versluys, 1906, p. 143, fig. 178).

The armature of the zooids, while basically like that of *Calyptrophora japonica* Gray (1866, p. 25; Versluys 1906, p. 113), is quite unlike any other described form. The spines of the basal ring are relatively longer and much stouter than those of the type of *C. japonica* as described by Versluys. The zooids of *C. juliae* are stouter and larger than those of *C. clarki* Bayer 1951, and the marginal processes of the buccal ring are never so strongly developed; the buccal ring of *C. juliae* bends adaxially more sharply than does that of *C. clarki;* and so far as I can determine, its opercular scales are never divided apically into lobes.

The close-set whorls of zooids, with their strongly projecting spines, give even this single branch a distinctive appearance, and the entire colony must have been one of striking elegance.

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ICHTHYOLOGY.—*Eight new fishes from the Gulf coast of the United States, with two new genera and notes on geographic distribution.* ISAAC GINSBURG, U. S. Fish and Wildlife Service. (Communicated by Ernest A. Lachner.)

In the course of my studies of the fishes of the Gulf of Mexico, eight species were found not to have been named previously. This conclusion was reached after a virtual revision of the species of their respective families that occur in the Gulf and adjacent waters. Only one of the species is based on a single specimen. The others are based on sufficient numbers to indicate that they are not uncommon. Three of them are common enough to enter the commercial fish catch at the present time. One offshore species apparently occurs in sufficient numbers to have market possibilities.

During an investigation of the southern species of commercial shrimps, the U. S. Fish and Wildlife Service, by means of the research boat *Pelican*, preserved and brought together a collection of fishes on the coast of our Southern States, which is of great value in the study of the ichthyological fauna of the Gulf and adjacent waters. It is my privilege to be engaged in a study of this collection, and four of the species herein described were obtained by the *Pelican*.

Three of the species indicate a peculiarity of geographic distribution of the fish fauna of the Gulf, to which attention is called and which is discussed at a later point.

The photographs for Figs. 1–8 were made in the Smithsonian Photographic Laboratory.

Family SERRANIDAE

Centropristes melanus, n. sp.

GULF BLACK SEABASS

D X 11. A III 7. P 17–18. Sc 47–49.

Dorsal and anal spines and rays constant (in 12 specimens). Gill rakers on lower limb 10–14 with 1–4 tubercles, or 14–17 altogether; on upper limb gill rakers grade gradually into tubercles or the difference between the two kinds only moderately indicated, 7 or 8 altogether; total number of gill rakers and tubercles on both limbs 21–25.

Body elongate, moderately deep. Mouth terminal, lower jaw subequal to upper in front or slightly projecting. Maxillary ending under middle of eye or posterior margin of pupil, without supplemental bone; a broad, rather shallow elongate groove below upper maxillary edge, setting off an elongate, moderately depressed piece having somewhat the shape of a supplemental maxillary (as in *Epinephelus*), but without an evident suture. Teeth in jaws in bands of medium width, widest in upper jaw; side of lower jaw with only two rows of teeth; outer and inner teeth moderately enlarged; no canines; none of the teeth depressible to a marked extent. Opercle drawn out posteriorly to form a rather long, flexible flap; middle opercular spine well developed; lower spine moderate; upper spine not developed, in form of blunt, rounded protuberance. Preopercle not expanded; its transverse margin well serrate; lower margin rather sparsely serrate, the serrae covered by skin; serrae at angle slightly enlarged; interopercle and subopercle moderately serrate or smooth. Branchiostegal rays 7. Scalation on midback ceasing at moderate distance behind eye, its anterior boundary a nearly straight, transverse line; cheek and opercle scaled; interopercle sparsely scaled; patch of scales over cheek and opercle moderately or rather well separated from posterior scales; interorbital, snout, suborbital, maxillary and lower jaw naked; proximal part of caudal rather well scaled for a considerable distance, scaleless posteriorly; other fins scantily scaled near their base; all scales ctenoid (besides small scales on fins), except those on chest sometimes cycloid. Lateral line moderately rising anteriorly, running nearly parallel to contour of back and at some distance below it, making a slight curve at caudal peduncle; 4 or 5 longitudinal rows of complete scales between highest part of lateral line and midback, besides a row of incomplete scales; modified, channeled scales in lateral line moderately smaller than adjacent normal scales, not separated by latter or only slightly so. First three dorsal spines abruptly and nearly evenly or somewhat unevenly graduated; first and second usually about half as long as second and third, respectively; third spine only a little shorter than fourth and longest; thence very gradually decreasing in length to eighth; last two spines subequal to or slightly longer than the one immediately preceding; last spine moderately shorter than first ray, emargination between spinous and soft parts of dorsal moderate. Second anal spine a little shorter and slightly stouter than third. Ventral about reaching anus or falling a little short, its outer angle a little in front of lower pectoral angle. Pectoral having its posterior margin nearly truncate, rounded at angles, more so below than above, ending nearly on same vertical as ventral or a little behind. Caudal asymmetrical, rounded for its greater and lower part, a moderate emargination above, the second branched ray from top moderately or slightly produced.

Measurements of four specimens 95–136 mm in standard length, and two, including the holotype, 177–206 mm, expressed as a percentage of the standard length, the ranges of the smaller specimens in parenthesis, as follows: Depth (33.0–38.5) 35–36, depth of peduncle (13.5–14.5) 13–13.5, head to end of flap (40–41.5) 41–44, maxillary (17–18.5) 20.5–21, snout (11.5–12.5) 12.5–13, eye (8.5–9.5) 8–9, interorbital (7–8.5) 7.5.

General ground color dark to nearly black; often with very faint traces of irregular, wide darker cross areas, separated by narrower, slightly lighter interspaces; scales with a lighter colored area on exposed part anteriorly, surrounded peripherally with dark pigment, presenting in gross appearance effect of beadlike longitudinal lines of light spots along rows of scales; no definite dark spot at posterior end of spinous dorsal base; a diffusely dusky area on inner side of opercle, at its upper, anterior part, but no well-defined spot on inner or outer surface of opercle; anal and ventral dark, sometimes edged with lighter color; pectoral uniformly very moderately dusky or nearly pigmentless; dorsal with obliquely lengthwise rows of diffuse light spots; caudal with very faint spots, almost uniformly dusky or dark.

Holotype.—C.N.H.M. no. 33719. Newport, near Wakulla, Fla.; November 10, 1937; Fred Ladd; 270 mm.

Paratypes.—C.N.H.M. nos. 33717–8, 33721–3; same data as holotype. Pensacola, Fla.; S. Stearns

TABLE 1.—FREQUENCY DISTRIBUTION OF THE NUMBER OF GILL RAKERS AND PECTORAL RAYS OF CENTROPRISTES MELANUS AND C. STRIATUS

Species	Total gill rakers and tubercles on both limbs								Gill rakers and tubercles on lower limb only						Pectoral rays			
	21	22	23	24	25	26	27	28	14	15	16	17	18	19	17	18	19	20
melanus	1	4	6	1	1				1	5	5	1			8	5		
striatus					8	6	15	1			1	13	14	2		8	23	1

(U.S.N.M. no. 21483). St. Marks, Fla.; B.C. Marshal; August 1931 (92232). Aucilla, Fla.; *Fish Hawk* station 7147; 3 fathoms; November 6, 1901 (73009). Cedar Keys, Fla.; C. R. Aschmeier; March 3, 1938 (106990). Total 11 paratypes 48–270 mm.

Remarks.—This species differs from the other two species of *Centropristes* occurring in the Gulf, *ocyurus* and *philadelphicus*, in having fewer scales and more gill rakers (scales 53–57 and total number of gill rakers and tubercles on both limbs 18–21 in the latter two species) and in not having the caudal biconcave, besides other minor differences. It is very close to the Atlantic *C. striatus*. As shown in Table 1, *melanus* diverges from *striatus* in the combined gill raker and tubercle count, that on the lower limb of the first gill arch and also in the total of both limbs, to a degree that is of species magnitude or very nearly so. A high divergence of the pectoral count is also indicated, but of lesser magnitude. Also, in *striatus* the emargination on the upper part of the caudal is generally more pronounced, and the second branched ray from the top is usually much more prolonged. The data for *striatus* given in Table 1 are based on specimens ranging from Woods Hole, Mass., to New Smyrna, Fla.

Three species of *Centropristes* occur in the Gulf, *melanus*, *philadelphicus*, and *ocyurus*. The species here described is the counterpart of *striatus* from the Atlantic. By their long isolation, the Gulf and Atlantic populations have diverged morphologically to a degree of species magnitude, or at least to a degree that is at the borderline of species and subspecies. I have also compared the Gulf populations of *philadelphicus* and *ocyurus* with their corresponding populations in the Atlantic and find some differences; but those differences are of low degrees, below the subspecies level. It is reasonable to assume that all the populations have been isolated by the peninsula of Florida equally in point of time. It is interesting then to note that in the same genus there is an evident wide difference in the tempo of population divergence.

Weed (1937) treats of the species of *Centropristes* and describes a new species, *springeri*, from the Gulf. His treatment in some respects is unsatisfactory. He does not adequately describe the well-marked difference in the shape of the caudal between *striatus* and *philadelphicus*, which evidently constituted the main character on which Gill established a distinct genus, *Trilobus*, based on *philadelphicus*; but the caudals of his specimens might have been damaged. He further states that the scale count is the same in all the species; whereas I found it to be a good character for separating *striatus* and *melanus* from *ocyurus* and *philadelphicus*. The latter discrepancy might be due to differences of method; Weed counted the scales in the lateral line, while my counts are of the number of oblique rows above the lateral line. I have reexamined the three specimens on which Weed based his *springeri* and find that they belong to the same species as the holotype of *ocyurus*, and consequently these two names are synonymous, *ocyurus* having priority.

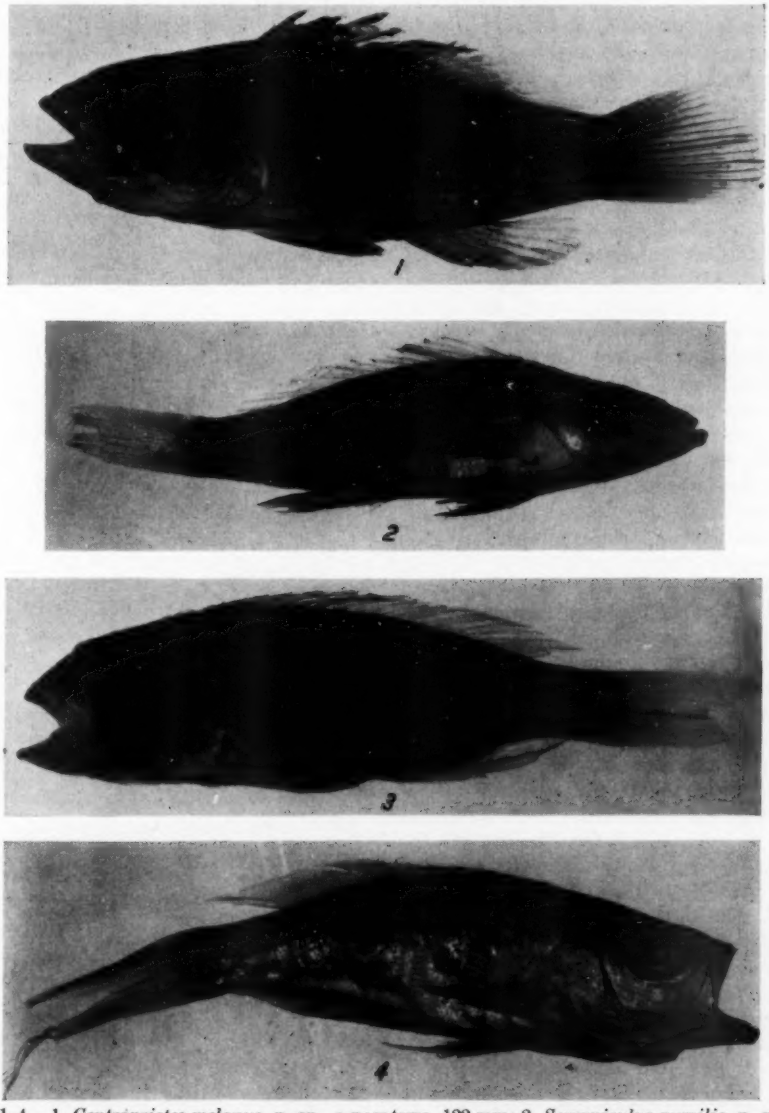
Serraniculus, n. g.

Genotype.—*Serraniculus pumilio*, n. sp.

Body elongate, rather spindle-shaped. Mouth subsuperior, the lower jaw moderately projecting. No supplemental maxillary. Upper jaw without notch. Teeth in jaws in rather wide bands; in two rows on side of lower jaw; outer teeth in both jaws and inner teeth in lower jaw enlarged, a few moderately enlarged inner teeth at symphysis of upper jaw also; inner teeth on side of lower jaw largest, 3 or 4 of those teeth moderately larger than adjacent ones but hardly large enough to be designated canine; vomer and palatines with teeth; tongue toothless. Lower two opercular spines well developed; upper spine short and pointed or a rounded, slight protuberance. Transverse margin of preopercle serrate, lower margin smooth. Branchiostegal rays 6. Gill rakers short, few. End of posttemporal not covered by skin, exposed in form of rather heavy scale (often referred to as "axillary scale"). Body entirely covered with ctenoid scales, including chest and pectoral base; opercle and cheek scaled; interopercle scaled for a variable distance at its posterior end only; dorsal aspect of occiput interorbital, snout, suborbital, maxillary and lower jaw scaleless. Lateral line rising moderately in front and making a slight curve at caudal peduncle; three longitudinal rows of complete scales between highest part of lateral line and midback, besides a row of incomplete scales; modified, channeled scales in lateral line notably smaller than adjacent normal scales and separated by them. All dorsal spines pungent and of normal length. Caudal having its distal margin very slightly rounded.

This genus is near *Centropristes*, structurally and in general appearance. *Serraniculus* differs

in constantly having six branchiostegal rays, instead of seven. The caudal shape is as in the young of *Centropristes* and markedly unlike that of the adults. That is, *Serraniculus* retains the juvenile caudal of *Centropristes* also in the adult stage. *Serraniculus* differs as well from all other known serranid genera on the Atlantic coast of North America in having six branchiostegal rays. As errors in the treatment of this character have entered the literature, which have been copied and repeated by successive authors, the pertinent literature of the species concerned is here briefly reviewed in connection with the establishment of *Serraniculus*.



FIGS. 1–4.—1, *Centropristes melanus*, n. sp., a paratype, 122 mm; 2, *Serraniculus pumilio*, n. gen. and sp., holotype; 3, *Paracentropristes pomospilus*, n. sp., holotype; 4, *Anthiasicus leptus*, n. gen. and sp., holotype.

Jordan and Evermann (1896, pp. 1218–1219) erroneously place *Centropristes subligarius* Cope and *C. dispilurus* Günther in *Dules* Cuvier on the assumption that they have six branchiostegal rays. However, in 21 and 5 specimens of those two species, respectively, which I examined in the National Museum, the branchiostegal rays are constantly seven. Also, in those two species the dorsal spines are normal in length and pungency, none being notably produced. *Dules*, on the other hand, is a monotypic genus characterized by a combination of two salient characters, the presence of only six branchiostegal rays and the striking whiplike prolongation and flexibility of the third dorsal spine. These two characters hold in all 14 specimens of what is presumably *Dules auriga* Cuvier, which I examined in the National Museum from the general region of Río de la Plata, South America. *Serraniculus* has six branchiostegal rays like *Dules*; but otherwise the two genera seem only remotely related. *Dules* differs from *Serraniculus*, apart from the structure of the third dorsal spine, in having a notably deeper body, a long, somewhat pointed snout, a deeper and shorter caudal peduncle and more numerous dorsal rays, the latter often being a generic character in the family Serranidae.

Boulenger (1895, p. 287) erroneously placed *subligarius* and *dispilurus* as synonyms of *Dules auriga*, claiming that the former two names represent females and the latter name males of the same species. Judged by his listed specimens, Boulenger evidently examined only three specimens, one *auriga*, two *dispilurus* and none of *subligarius*, and based his sex determination and conclusion on these three specimens. In reality, these three names represent three separate species which are very readily distinguishable, much more so than some other closely related serranid species.

Fowler (1907, p. 265) establishes a new subgenus, *Callidulus*, under *Dules* (which he renames *Eudulus*), based on *subligarius* as the genotype, again on the erroneous assumption that *subligarius* has six branchiostegal rays. The new name *Callidulus* (as well as *Eudulus*) is an unnecessary addition to the nomenclature, as *subligarius* is near enough to *Serranus scriba* Linnaeus to be placed in the same genus; while *scriba* is the genotype of *Serranellus* Jordan (in Jordan and Eigenmann, 1890, p. 399). Therefore, *subligarius*, and the closely related *dispilurus*, should be placed in the genus *Serranellus*. On a revision of the family, it might be found advantageous to treat *Serranellus* as a subgenus of *Serranus*, as it was treated by Jordan and Eigenmann.

The untenable placement of *subligarius* and *dispilurus* by Jordan and Evermann and their erroneous treatment by Boulenger are perhaps due, in part, to the three species having two general features in common: (1) the shape is rather unusual and similar in all three species, and (2) they also have a light yellowish color more or less developed in the abdominal region. Either these features represent parallel developments in *Dules auriga* or else the latter is derived from *Serranellus* but has become modified to such an extent as to represent a divergence of genus magnitude.

The five specimens of *dispilurus* which I examined, as noted above, so labeled in the National Museum collection, evidently correctly, are from Jamaica and Puerto Rico. Jordan and Eigenmann (1890, p. 405) venture the opinion that *dispilurus* is a synonym of *Dules flaviventris*, which Cuvier and Valenciennes (1829, p. 113) originally described from Brazil. Judged by the brief description of the latter species, the suggested synonymy seems well advised; but I have no specimens from Brazil to verify it. Should that synonymy prove to be correct, then Cuvier and Valenciennes were also in error in placing *flaviventris* in *Dules*, as they based that genus, first established in the publication cited above, on the presence of six branchiostegal rays.

The first branchiostegal ray in serranids is often short, thin, and closely approximated to the second ray, and it might be overlooked unless particular care is exercised. This perhaps explains some of these errors that entered the literature.

Serraniculus pumilio, n. sp.

D X (10) 11. A III 7. P 14–15. Sc 44–46. GR 5–7.

Dorsal rays normally 11 (in 20), infrequently 10 (in 1); dorsal and anal spines and anal rays constant (in 21). Pectoral rays 14 (in 12) or 15 (in 9). Gill rakers on lower limb 5–7 with 1–4 tubercles, or 8–11 altogether; upper limb with 0–3 gill rakers and 0–4 tubercles, or 3–5 altogether; total number of gill rakers and tubercles on both limbs of the first gill arch 11–14. Body and caudal peduncle of medium depth; upper profile rising moderately from snout to dorsal origin; peduncle deeper than eye diameter; dis-

tance from a median point under end of dorsal to caudal base, greater than eye diameter; maxillary ending under anterior margin of pupil or slightly behind. First three dorsal spines rapidly and almost evenly graduated; the first a little less than one-half as long as second; second a little more than one-half as long as third; third to fifth subequal or slightly increasing in length, thence gradually decreasing to ninth; tenth spine a little longer than ninth and moderately shorter than first ray, emargination between spinous and soft parts of dorsal moderate. Ventral rather short, falling short of anus, its end at a more anterior point than that of pectoral, its outer angle slightly in front of lower pectoral angle, its spine about one-half as long as rays. Distal margin of upper two-thirds of pectoral a well-inclined line, its lower angle rounded.

Diffusely and irregularly cross-banded; with four diffuse, dark or dusky bands, the first under dorsal origin, the last at caudal base; anterior three bands broader than interspaces, last band comparatively narrow, preceded by broad lighter interspace over greater part of caudal peduncle; the bands without definite boundaries, the dark shade more or less encroaching and becoming diffuse on interspaces; sometimes bands and interspaces hardly distinguishable, except light interspace on peduncle; interspaces often with a silvery tinge, the interspace between first and second bands often especially prominent as a transverse silvery band on lower two-thirds of body, under middle of spinous dorsal; a series of small dark spots on upper profile often distinguishable, 4 or 5 at dorsal base, the first at base of last spine, the fourth or fifth at end of dorsal somewhat more prominent, one at end of peduncle and one or two on upper margin of caudal near its base; a characteristic, yellowish, rounded spot directly behind last dark band, at its lower half; sometimes a similar spot, smaller and not as well marked, also at its upper half; a light streak along course of lateral line with dark very small spots placed at somewhat irregular intervals; spinous dorsal usually with a large dark blotch a little below its distal margin, between seventh and ninth spines, often hardly perceptible; anterior margin of dorsal often with three dark dots, one above the other; ventral and anal almost uniformly dark to black; other fins usually rather sparsely pigmented, without rows of well marked spots, except some irregular shadings, and caudal and lower pectoral edge broadly margined with dusky or blackish.

Measurements (expressed as a percentage of the standard length) of three specimens 56–59 mm, including the holotype, and 3, 70–80 mm, those of the smaller specimens in parenthesis: caudal (25–26) 24–25, ventral (24–25) 22–23, pectoral (26–28.5) 26.5–28.5, depth (27–29.5) 29.5–31, depth of peduncle (12.5–13.5) 13–13.5, head (34.5–35) 35.5–36, maxillary (13–14.5) 14–15, snout (8.5–9.5) 9–10.5, eye (9.5–10) 8.5–9.5, interorbital (5–6) 5.5–6.5.

Holotype.—U. S. N. M. no. 133791. *Fish Hawk* station 7177; lat. 29° 05′ N., long. 83° 22′ 30″ W.; off Cedar Keys, Fla.; 5½ fathoms; November 27, 1901; 56 mm.

Paratypes.—Off Mobile Bay, Ala. (U.S.N.M. nos. 101521, 144164–5). Georgia (149971). Off Cape Lookout, N. C. (131015). Texas; Texas Game, Fish and Oyster Commission (C.N.H.M.). Also, the following *Pelican* stations: Off Cape Canaveral (station 208—2) and St. Augustine (208—8), Fla.; off St. Andrews Sound (177—12), St. Simon Island (178—7) and Ossabaw Island (180—7), Ga.; off Head Island (182—8), St. Helena Sound (195—2) and Edisto Island (194—13), S. C. Total paratypes 20, taken in 6–32 fathoms, 33–80 mm.

Remarks.—The abdominal cavity of one 63-mm specimen was exposed to examine the gonads. They were found to contain ripe eggs. The structure of the gonads does not appear to be uniform in gross appearance. Interspersed with the masses of ripe roe are areas of tissue which have the gross appearance of milt. It seems probable, therefore, that this species is hermaphroditic like some other serranids.

This is the smallest American serranid discovered so far. It is readily distinguished by its generic and specific characters. Its relationship is discussed above under the account of the genus.

Paracentropristes pomospilus, n. sp.

Prionodes atrobranchus Longley (not Cuvier and Valenciennes), Carnegie Inst. Washington Publ. 535:106. 1941 (Tortugas).

D X 12. A III 7. P 14–17. Sc 46–48. GR 9–11.

Dorsal and anal spines and rays constant (in 26 specimens). Pectoral rays normally 16 (only 4 variants in 57 specimens, 14 and 15 in one each, and 17 in 2). Gill rakers on lower limb 9–11, with 1–3 tubercles, or 10–13 in combined number; upper limb with 6 or 7 gill rakers and tubercles combined; total combined number of gill rakers

and tubercles on both limbs 17–20. Rather spindle-shaped, depth medium; depth of caudal peduncle somewhat greater than eye diameter. Snout subequal to or slightly shorter than eye. Mouth terminal, lower jaw subequal to upper or slightly projecting. Maxillary without supplemental bone, ending approximately under middle of eye. Teeth small, in narrow bands, widest in upper jaw, in two rows on side of lower jaw; upper jaw having outer teeth and a few inner teeth at symphysis larger than others; lower jaw having a few anterior outer teeth and all teeth in inner row enlarged; some inner teeth on middle of side of lower jaw larger than all others, but not large enough to be designated canine. Opercular spines poorly developed, short, stubby or slightly pointed. Preopercle serrate; serrae on lower margin stronger than those on transverse edge, except without serrae anteriorly for a third the distance or less. Scalation on antedorsal area extending to eye and continued on interorbital space approximately to opposite posterior margin of pupil; cheek, opercle, and interopercle completely scaled; anterior part of interorbital, snout, suborbital, maxillary, and lower jaw scaleless; 3 or 4 rows of complete scales between highest part of lateral line and midback; modified, channeled scales in lateral line notably small, widely separated by adjacent normal scales. First three dorsal spines nearly evenly graduated, the second about two-thirds as long as third; fifth or sixth spine longest or the two subequal, the length very gradually decreasing to third and last spines; first ray moderately longer than last spine, emargination between spinous and soft parts of dorsal slight. Second anal spine shorter and slightly stouter than third. Ventral pointed, reaching anus or a little short. Pectoral having distal margin of its upper two-thirds in a moderately inclined line. Caudal moderately and asymmetrically lunate, the upper lobe longer.

Measurements of four specimens 114–120 mm, including the type: Caudal (upper lobe) 25.7–31.0, ventral 27.0–29.5, pectoral 29.0–32.5, depth 31–35, depth of peduncle 12.5–14.0, head 34.5–37.5, maxillary 16.0–17.5, snout 9.0–10.5, eye 11.0–11.5, interorbital 5.5–7.0.

General color a nearly uniform light brownish or yellowish; sometimes very faint indication of dusky rather narrow cross bands, in an occasional specimen a somewhat obliquely placed cross band on body under base of eighth to ninth spine fairly marked; a lengthwise row of small, light yellowish spots, subtriangular or irregular, on body behind head, a little above pectoral base, ending near end of pectoral, discernible only in the smaller specimens having the scalation nearly intact, imperceptible in the majority of specimens; some specimens with trace of a narrow black margin on anal and caudal; belly with a silvery tinge, better marked on chest; upper part of opercle with a large black or dusky area on inner surface, visible externally as a dark spot, often divided into two spots; no dorsal spot or other color marks.

Holotype.—U. S. N. M. no. 151883. *Pelican* station 108—1; lat. 28° 03′ 30″ N., long. 95° 41′ 30″ W.; off St. Joseph Island, Tex.; 26 fathoms; January 23, 1938; 120 mm.

Paratypes.—Three specimens obtained with the holotype; 29 other specimens collected by the Pelican at 19 other stations off the following localities: Padre Island and Corpus Christi, Tex.; Atchafalaya Bay, Grand Isle, and Mississippi Delta, La. Also, specimens in the National Museum taken off Dauphin Island, Ala., and Tortugas, Fla. Total number of paratypes 56, 75–133 mm. Depth records for these lots range 20–90 fathoms.

Remarks.—This species has been compared with the Mediterranean (Labrus) *Paracentropristes hepatus* (Linnaeus), the genotype of *Paracentropristes* Klunzinger. The Mediterranean species differs in having the scales 52–57, the interorbital nearly all scaled and the caudal very moderately emarginate. However, the two species are similar to a sufficient extent to be placed in the same genus. Among American species *pomospilus* is related to (Serranus) *Paracentropristes notospilus* (Longley). The two American species differ in a number of characters, the most striking of which are: the very poorly developed opercular spines of *pomospilus*, its deeper caudal peduncle, the lack of a dorsal spot and the presence of an inner opercular spot.

Longley refers specimens of this species to *Centropristes atrobranchus* Cuvier and Valenciennes. However, these authors (1829, p. 45), state that their species has a large black spot on the dorsal. Jordan (1887, p. 532) and Boulenger (1895, p. 289), both of whom examined and described the type specimen and placed the species under *Serranus*, state that it has a "jet black" and "inky black" blotch on the dorsal. In contrast, the 33 specimens recently preserved by the *Pelican* do not show a trace of such a spot, and this also holds for the other 24 specimens examined; while the presence or absence of a

dorsal spot is often a good specific character in serranid species. Moreover, judged by Boulenger's description there is another, structura' difference. He states of the type of *atrobranchus*: "preopercle finely serrated, the serrae coarser at the angle, obsolete on the lower border . . . ;" while in our specimens the serrae on the posterior two-thirds of the lower border, are well developed and as coarse as at the angle. It is evident that the species here described is not the same as Cuvier and Valenciennes's *C. atrobranchus*.

Anthiasicus, n. g.

Genotype.—Anthiasicus leptus, n. sp.

Body comparatively slender. Mouth superior. Supplemental maxillary absent. Upper jaw with a moderate notch at symphysis. Teeth in jaws in narrow bands, except in a single row on side of lower jaw; outer teeth very moderately enlarged; both jaws with two small canines in front and two inner canines; a caninoid on side of lower jaw; vomer and palatines with teeth; tongue toothless. Opercular spines poorly developed; the two lower ones short, obtuse; the upper not developed, a mere rounded protuberance. Transverse margin of preopercle rather well serrate; serrae on lower margin sparse; one serra at angle of preopercle rather large, subtriangular; interopercle and subopercle with a smooth edge. Gill rakers long, numerous. Branchiostegal rays seven. End of posttemporal not covered by skin, exposed in form of rather heavy scale. Scales comparatively numerous; anterior boundary of scalation a nearly straight transverse line at posterior margin of eye; interopercle scaled; interorbital, snout, suborbital, maxillary and lower jaw scaleless. Lateral line placed at a considerable distance below dorsal contour, five longitudinal rows of complete scales between highest part of lateral line and midback, besides two rows of smaller scales at dorsal base; modified, channeled scales in lateral line moderately smaller than adjacent normal scales and moderately separated by them. All dorsal spines pungent and of normal length. Pectoral pointed. Caudal deeply lunate, the lobes filamentous, nearly half as long as standard length.

Anthiasicus is evidently allied to the group of serranid genera which is partly characterized by having numerous rather long gill rakers, in addition to other characters. As compared with its near relatives in that group it differs from *Pronotogrammus* in the low position of lateral line and the relatively small scales. From *Hemanthias*, it differs in having the third dorsal spine of normal length and pungency, not greatly prolonged and flexible, and in the deeply lunate caudal. From *Ocyanthias* it differs in the low position of the lateral line, the absence of teeth on the tongue, and the small scales. From *Anthias* it differs in not having the anterior part of the head scaled, in the notably shorter third dorsal spine, in the small scales, and in not having the ventrals greatly prolonged. The body is notably slenderer than in any of those genera.

Anthiasicus leptus, n. sp.

D X 14. A III 8. P 19. Sc 78. GR 10–26.

Eye rather large, subequal to snout, a little less than peduncular depth, about three times in head. Maxillary ending under anterior margin of pupil. First three dorsal spines nearly evenly and rapidly graduated, the first two-thirds as long as second, third moderately shorter than fourth and longest, thence gradually and slowly decreasing in length to last; last spine about three-fifths as long as first ray, emargination between spinous and soft parts of dorsal rather well developed; dorsal spines with very short filaments or tabs. Second anal spine moderately shorter and stouter than third. Ventral somewhat filamentous reaching a little past anal origin, its outer angle under lower pectoral angle. Pectoral reaching a vertical through vent. Color nearly uniform, golden above shading to silvery below; fins straw yellow; no distinctive color marks.

Measurements (expressed as a percentage of standard length). Standard length 108 mm; caudal upper lobe 48.5, lower lobe 46.5; ventral 28.5; pectoral 23.5; depth 31; depth of peduncle 13.5; head 36; maxillary 16.5; snout 11; eye 12; interorbital 8.5.

Holotype.—U. S. N. M. no. 134189; *Albatross* station 2378; lat. 29° 14′30″ N., long. 88° 09′ 30″ W.; off Dauphin Island, Ala.; 68 fathoms; February 11, 1885; 160 mm; the only specimen examined.

The relationship of this species is discussed above under the genus. It is easily distinguished from all known Gulf serranids by the combination of its generic and specific characters, especially its fin ray, scale and gill raker counts.

Family LUTIANIDAE

Pristipomoides andersoni, n. sp.

Pristipomoides macrothalmus Hildebrand (not Müller and Troschel), Carnegie Inst. Washington Publ. 535:120. 1941.

D X (10) 11. A III 8. P 14–16. Sc 49–53. GR 16–17.

Dorsal rays normally 11 (in 36), infrequently 10 (in 1). Dorsal and anal spines and anal rays constant (in 38). Pectoral rays modally 16 (in 20), nearly as often 15 (in 16), sometimes 14 (in 2). Gill rakers on lower limb 16 or 17 with 0–2 tubercles in 24 specimens 100–240 mm, 16–18 with 0 or 1 tubercle in 14 specimens 44–95 mm, the total number of gill rakers and tubercles in both size groups 16–18; upper limb with 7–10 gill rakers, the 2–4 near angle of arch longer and nearly evenly graduated, the upper ones more or less abruptly short, the uppermost one sometimes tubercle-like; combined number of gill rakers and tubercles on both limbs, at all sizes, 24–28. Body rather deep, well compressed, somewhat spindle-shaped, ventral curvature only moderately less than dorsal. Snout rather short, blunt, subequal to or a little longer than large eye. Interorbital flat and broad, only a little narrower than eye diameter. Mouth well inclined, terminal, lower jaw only slightly projecting. Suborbital moderately wide. Maxillary ending under anterior margin of pupil or a little behind. Teeth on jaws, vomer and palatines small, in narrow bands, except outer and inner teeth in jaws and inner teeth on vomer more or less enlarged; upper jaw having one or two outer teeth near to and on both sides of symphysis large, caninoid, the other outer teeth smaller and gradually decreasing in size posteriorly; vomerine band of teeth somewhat in form of an arch with a shallow concavity posteriorly and crowned by a blunt apex anteriorly, without a backward extension on the shaft; no teeth on tongue. Opercle having a moderate spinous projection in a line with lower margin of eye, another projection at some distance above it blunt, broadly rounded. Preopercle without or with a very slight emargination on vertical edge, its horizontal edge serrate nearly all the way forward. Interorbital scaleless, boundary of scalation on midback opposite posterior margin of eye or slightly behind; an oblique band of scales on nape over cheek and opercle, well separated from rest of scales; greater part of interopercle scaled with 2–3 rows of scales; lengthwise rows of scales above lateral line parallel to it; dorsal and anal scaleless. Dorsal spines rather slender, first three very unevenly graduated, the first about half as long as second, the second only a little shorter than third, the last subequal to second; first dorsal ray very moderately longer than last spine, soft and spinous parts of dorsal nearly continuous. Anal spines very moderately stout, the first about half as long as second, the second a little shorter than third. Last dorsal and anal ray longer than preceding rays. Ventral about reaching anus. Pectoral about reaching a vertical through base of first anal spine. Caudal deeply lunate, the upper lobe somewhat longer.

Measurements of two specimens 178–216 mm, including the type and two specimens 81–94 mm, those of the smaller specimens in parenthesis: caudal (upper lobe) 33.5–35.0 (30.0–32.5), ventral 26.0–26.5 (24.5), pectoral 31–32 (30.0–31.5), depth 37.0–40.5 (36–39), depth of peduncle 11.5 (12), head 35–38 (37.5–38.5), maxillary 16.0–16.5 (16–17), snout 11.5–12.5 (10.5–11.5), eye 10.5–11.0 (12–13), interorbital 9.5–11.5 (10.5–11.0).

General color of preserved specimens straw yellow, often with a slight reddish tinge; lower half often partly or almost wholly with a silvery tinge; often with a few very small, rounded or elongate, dark spots on lateral line spaced at irregular intervals or bunched close together, sometimes similar spots in oblique row on nape; no other distinctive color marks; fins plain yellowish. In life the species is of a prevailing pink color.

Holotype.—U. S. N. M. no. 151882. *Pelican* station 40; lat. 27° 24′ 30″ N., long. 96° 13′ W.; off Padre Island, Tex.; 90 fathoms; 216 mm.

Paratypes.—Two specimens obtained with the holotype; 27 other specimens collected by the *Pelican* at 17 stations off the following localities: Padre Island, Corpus Christi, and St. Joseph Island, Tex.; Marsh Island and Atchafalaya Bay, La.; Horn and Petit Bois Islands, Miss.; Perdido Bay and Cape San Blas, Fla. Also, specimens in the National Museum taken at Tortugas, Fla., and off Dauphin Island, Ala. Altogether 37 paratypes 44–263 mm. Depth records, available for all except two lots, range 13–95 fathoms.

This species differs from the West Indian (*Centropristes*) *Pristipomoides macrophthalmus* (Müller and Troschel) in having more gill rakers and fewer scales. In three specimens of *macrophthalmus* from Cuba, 200–350 mm, the gill rakers on the lower limb are 11–12 and 2–4 tubercles or 13–16 altogether; on upper limb 6 or 7 gill rakers and tubercles combined; total number of gill rakers and tubercles on both limbs 20–22. This compares with a total count of 24–28 in 38 specimens of *andersoni* given above. The scale count in the Cuban specimens is 55–57 as compared with 49–53 for the 38 specimens of *andersoni*.

It is a pleasure to name this apparently common, offshore snapper after William W. Anderson, who, while carrying out an investigation of the species of commercial shrimp on the U. S. Fish and Wildlife research boat *Pelican*, inestimably served the science of ichthyology by industriously saving, preserving, and assembling as a unit a very valuable collection of fishes from off the Gulf and Atlantic coasts of our Southern States.

Family SPARIDAE

Pagrus sedecim, n. sp.

D XII 9–11. A III 8. P (15) 16. Sc 56–59. GR 9–11.

Dorsal and anal spines and anal rays constant (in 16). Dorsal rays usually 10 (in 14), sometimes 9 (in a specimen from North Carolina) or 11 (in a specimen from Brazil). Pectoral rays normally 16, sometimes 15 (16 on both sides in 14, 15 on both sides in one, 15 on one side and 16 on the other in one, both variants from the Carolinas). Upper limb of outer gill arch with 6 or 7 gill rakers; lower limb with 9–11 including one tubercle; total number on both limbs 15–17. Moderately deep (for a sparid); anterior profile rising steeply and making a smooth curve to dorsal origin; ventral profile nearly horizontal from head to anal origin. Snout long; preorbital broad; eye rather large. Mouth of medium extent, nearly horizontal, sub-terminal, lower jaw slightly included. Maxillary reaching a vertical through anterior margin of eye in the smaller specimens, a little short of that in the larger. Anterior part of jaws with a short outer row of strong, stout, nearly conical teeth, large enough to be designated canine, usually 4 teeth in upper jaw and 6 in lower, the middle two teeth in lower jaw much smaller than others; side of jaws with two rows of very stout, short teeth, anterior teeth in outer row subconical, rather pointed, changing to molars posteriorly, inner row shorter, the teeth all molar; an elongate patch of smaller teeth on both sides of midline behind outer anterior teeth, anterior teeth in patch rather conical and pointed becoming stouter and changing to small molars posteriorly; the patch of smaller teeth overlapping the two outer side rows of large teeth. Greater part of interorbital scaled, anterior boundary of scales curving to a point opposite anterior margin of eye; band of scales on cheek moderate, tapering upward. First four dorsal spines unevenly graduated, first nearly two-thirds as long as second; second and third about four-fifths as long as third and fourth, respectively; fourth longest, fifth subequal to it; procumbent spine absent. Second anal spine a little stouter than third, the two subequal in length. Ventral about reaching anus, its base a little behind that of pectoral. Pectoral long, falcate, reaching to over base of first to third anal spines. Caudal well lunate, upper lobe longer than lower.

Measurements of 3 specimens 366–425 mm, and two specimens 228–263 mm including the holotype, those of the smaller specimens in parentheses: Caudal (upper lobe) 29 (32.0–32.5), ventral 19.5–23.0 (23.5–24.0), pectoral 36.5–38 (35.5), depth 36.0–39.5 (38.5–40.5), head 30.5–32.5 (33.5–34.5), maxillary 13.0–13.5 (13.5), snout 13.5–16.0 (15.0), eye 7.0–7.5 (9.0–9.5), preorbital (across its greatest width, on a line oblique to axis of fish) 8.5–9.5 (9.5).

Ground color almost uniformly yellowish sometimes with a slight pinkish blush; upper half of body with many very small brownish spots, irregularly scattered above lateral line, roughly tending to an arrangement along longitudinal lines below it. The small spots are present in 4 specimens, 212–428 mm, which were preserved during the last 12 years, and absent in all others preserved for 25 years or longer. Apparently they disappear after long immersion in preservative. In life the ground color is of a reddish tinge and the spots are bluish.

Holotype.—U. S. N. M. no. 151881. 25 miles south of Pensacola, Fla., on snapper bank; 45 fathoms; July 31, 1938; collected by the *Pelican*; 208 mm in standard length; the caudal damaged at tip, about 263 mm in total length.

Paratypes.—Pensacola, Fla. (21339, 30838); off Cape Fear, N. C. (collected by the Albatross III); Charleston, S. C. (20981); Rio de Janeiro (83181), Brazil; a specimen obtained by the trawler *Santa Maria* on the coast of Brazil, locality not stated (87741); New York market (22868–9). Total paratypes 15, 138–507 mm.

Remarks.—This porgy, which is not uncommon on the American coast and sometimes enters the commercial catch, has been identified hitherto with the European *Pagrus pagrus*. However, the corresponding populations from the two sides of the Atlantic represent distinct species, as determined by comparing the 16 American specimens which form the basis of the preceding account with three specimens 155–391 mm from the Azores.

The American species normally has 16 pectoral rays, the three Azores specimens 15. As the total

number of available specimens are relatively few, the rays in both pectorals were counted for each fish. As stated above, of 32 counts of American fish 29 were 16 and 3 were 15. The six counts of Azores fish were all 15. Hence, out of 32 American counts three intergrade with the European species. This gives an index of divergence of 95 (Ginsburg, 1938), which is of species magnitude, judged by the small samples examined.

The American species has a slenderer caudal peduncle, as shown in Table 2, with no intergradation between the specimens measured.

Another possible difference refers to color. As described above, the American species has very small spots which disappear after long immersion in preservative, while no such spots are mentioned in descriptions of *Pagrūs pagrus* by European authors which were consulted.

TABLE 2.—FREQUENCY DISTRIBUTION OF THE DEPTH OF THE CAUDAL PEDUNCLE IN PAGRUS PAGRUS AND P. SEDECIM, EXPRESSED AS A PERCENTAGE OF THE STANDARD LENGTH

Species	9.0	9.5	10.0	10.5	11.0	11.5
sedecim	1	6	6	2		
pagrus					2	1

Archosargus oviceps, n. sp.

GULF SHEEPSHEAD

D XI–XII (XIII) 11–12. A III 9–10. P 15–17. Sc 45–49.

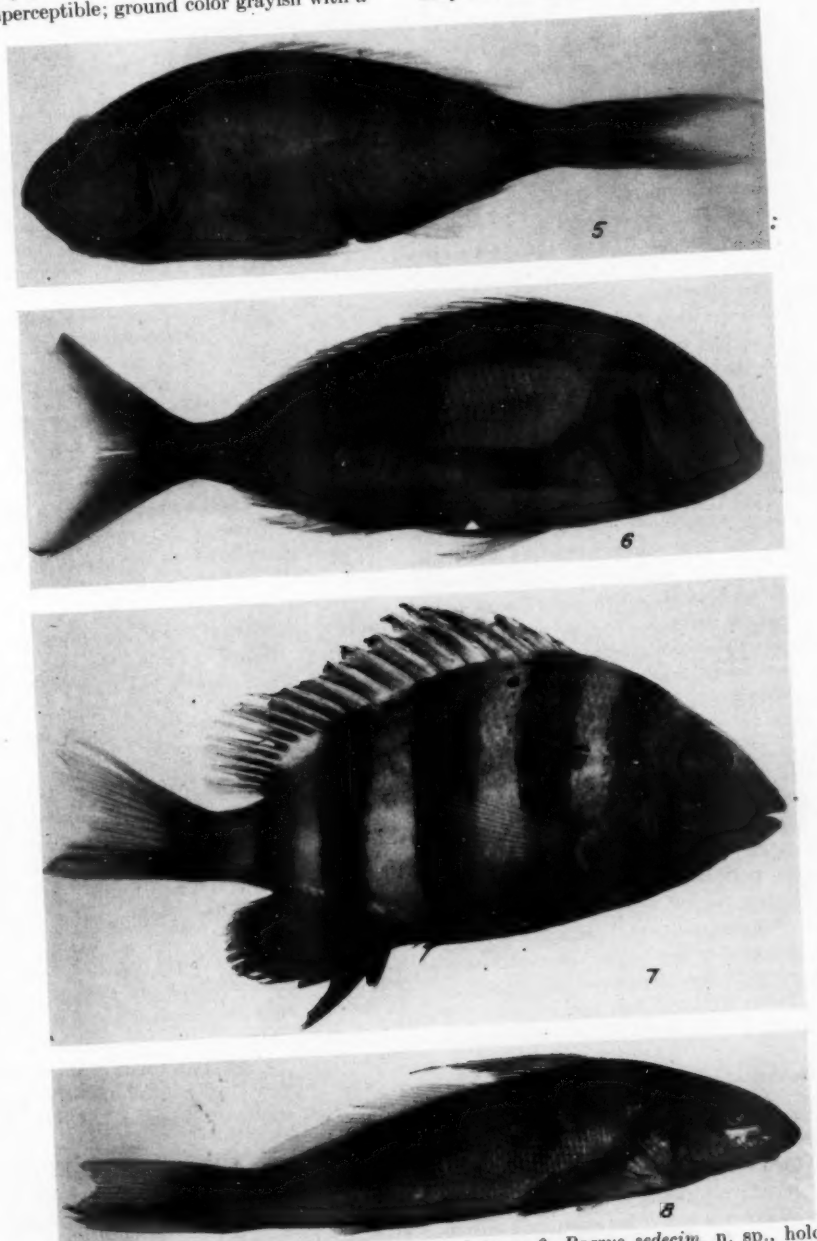
Dorsal spines modally 12 (in 20), very often 11 (in 11), infrequently 13 (in 1); dorsal rays modally 11 (in 20), very often 12 (in 12); number of spines and rays highly correlated, variants having 12 spines usually also having 11 rays and vice versa (D XII 11 in 17; D XI 12 in 10; D XII 12 in 2; D XI 11 in 1; D XIII 11 in 1). Anal spines constant; anal rays modally 10 (in 8), very often 9 (in 4). Pectoral rays modally 16 (in 16), often 17 (in 6), sometimes 15 (in 2). Glli rakers short, stubby, 6 or 7 on upper limb of first gill arch and 8 or 9 on lower, or 14–16 altogether. Notably deep, depth about one-half the standard length; anterior profile curving steeply to dorsal origin. Mouth rather small, terminal, only slightly inclined, nearly horizontal; the two jaws subequal in front. Maxillary ending under anterior margin of eye. Preorbital notably wide. Outer teeth broad incisors, confined to anterior part of jaws, six in upper jaw, eight in lower, with three notches or four cusps in young, becoming worn with growth; inner molars well developed, those behind incisors smaller and in three irregular rows, those on side notably broader and in two rows in lower jaw, three rows in upper jaw; no teeth on vomer, palatines or tongue. Opercle of nearly uniform thickness, forming a rather broad, rounded projection posteriorly, without spines (the projection nearly spinelike in small fish). Margin of preopercle slightly serrate to smooth. Anterior boundary of scalation a nearly horizontal, curved line with its apex on a vertical about through anterior margin of eye or a little behind; interorbital only partly scaled; cheek with a moderately broad, bandlike scaled area, tapering upward, anterior boundary of scales on cheek a line a little behind eye to end of maxillary; opercle and interopercle scaled; preopercle, preorbital, snout and lower jaw scaleless. Lateral line rising moderately upward, running at a considerable distance from, and nearly parallel to dorsal contour, slightly nearer it posteriorly than anteriorly, making a moderate curve at caudal peduncle. Anterior four dorsal spines rapidly and somewhat unevenly graduated, the first a little more than half as long as second, the fourth only slightly shorter than fifth and longest, thence gradually decreasing in length to last or penultimate; first ray moderately longer than last spine, emargination between spinous and soft parts of dorsal very moderate. Second anal spine longer and stouter than third. Ventral placed behind pectoral, about reaching anus, the outer ray usually a little prolonged. Pectoral about reaching third body band, that is, a vertical through approximately third anal spine. Caudal moderately emarginate.

Measurements of two specimens 103–115 mm and 2 large ones 235–247 mm, expressed as a percentage of standard length, measurements of smaller specimens in parenthesis. Caudal, slightly frayed (31–31.5) 30–30.5; ventral (29–29.5) 27–28; pectoral (35.5–36) 41–41.5, a little damaged in larger specimens; depth (48–53) 50.5–52.5; head (33.5 in both) 33–34; maxillary (12–13) 13 in both; snout (13.5–14.5) 15.5–17; eye (9–9.5) 7–7.5; interorbital (11–12) 11.5–12.5.

Sharply cross banded; a band on nape somewhat oblique, tapering downward, not extending on head, usually not as intensely pigmented as posterior bands; body with 5 broad black sharply marked bands extending nearly all the way down; first and fourth bands under beginning and end of dorsal, respectively, only two other bands under dorsal base; last band at caudal base; a transverse blotch on caudal, at its base, often

present, somewhat coalescent with last band; an axillary spot on lateral line, placed on and more intensely pigmented than first body band, sometimes imperceptible; ground color grayish with a silvery or golden tinge; dorsal, anal and ventral almost uniformly dark to nearly black; caudal dusky; pectoral yellowish.

Only two small specimens, 14–35 mm, have an



FIGS. 5–8.—5, *Pristipomoides andersoni*, n. sp., holotype; 6, *Pagrus sedecim*, n. sp., holotype; 7, *Archosargus oviceps*, n. sp., holotype; 8, *Menticirrhus focaliger*, n. sp., holotype.

asymmetrical color pattern, five body bands on one side, six on the other. All other 76 specimens have 5 body bands on both sides, except that in four of the smallest specimens the last one or two bands are more or less faint or irregular. As in *probatocephalus* (see below), specimens with an asymmetric color pattern possibly die before attaining any considerable size.

Holotype.—U. S. N. M. no. 144151. Barataria Bay, La.; Isaac Ginsburg; November 24, 1931; in shrimp trawl; 103 mm.

Paratypes.—Mobile, Ala. (19525). New Orleans, La.; Couch (727). Galveston, Tex.; D. S. Jordan (31041). Port Lavaca, Tex.; Graham (726). Brazos Santiago, Tex.; Emory (728) and J. Wurdemann (730). Tampico, Mexico; Snyder (62282). The following were collected on the coast of Texas by J. C. Pearson, in 1926: Gulf of Mexico (144158). Harbor Island (144152–5 incl., C. N. H. M.). Shamrock Cove (144156). Ingleside (144157). Corpus Christi (144160). Corpus Christi Pass (144159). Total paratypes 77 specimens, 11–355 mm.

Remarks.—This species differs from *A. probatocephalus* in normally having five bands on the body, not counting the band on the nape, instead of six. The band on the nape, the one at the caudal base, and one each under the beginning and end of the dorsal, occupy the same positions in *oviceps* and *probatocephalus*; but between the latter two bands *oviceps* has only two others, while *probatocephalus* has three. Other structural differences between the two species are not pronounced; *probatocephalus* apparently averaging a slightly higher dorsal spine count and slightly lower pectoral and gill raker counts.

Of the South American *A. aries* only one specimen was examined, from Venezuela. It is apparently nearer to *probatocephalus* than to *oviceps*. *A. aries* has six body bands like *probatocephalus*, but the bands are appreciably narrower. In meristic counts the single Venezuelan specimen agrees with *probatocephalus*, and the differences between *aries* and that species remains to be determined by a study of adequate samples.

Archosargus probatocephalus (Walbaum)

As the only substantial character determined that distinguishes *oviceps* from *probatocephalus* refers to the number of bands, a study of the variability and development of this character in *probatocephalus* was made for comparative purposes. Variation in the number of bands is shown in Table 3. All specimens are divided into three groups: (1) With six body bands, not including the incomplete band on the nape, (2) with five body bands, and (3) asymmetrical, five bands on one side, six on the other, the column heading being "6/5". Of the 269 specimens examined (six from western Florida, the rest from the Atlantic), 24 or slightly less than 9 percent are asymmetrical, and 14 or a little over 5 percent have five bands. The total of both variant categories is slightly over 14 percent.

TABLE 3.—FREQUENCY DISTRIBUTION OF NUMBER OF BODY BANDS IN ARCHOSARGUS PROBATOCEPHALUS

Locality	Length of specimens in mm	Distribution		
		6	6/5	5
Beesleys Point, N. J.	25–74	24	—	1
Beaufort, N. C.	10–68	182	24	13
Miscellaneous, Chesapeake Bay to Key West	71–361	19	—	—
Homosassa and Tampa Bay, Fla.	92–252	6	—	—

TABLE 4.—FREQUENCY DISTRIBUTION OF NUMBER OF BODY BANDS IN ARCHOSARGUS PROBATOCEPHALUS AS RELATED TO SIZE OF SPECIMENS

Length of specimens in mm. / Number of body bands	10–25	26–41	42–58	59–74	92–361
6	68	80	53	6	24
6/5	5	16	3	—	—
5	5	5	3	1	—

Table 3 also shows that all variants except one are from Beaufort. The latter composite sample comprises young fish, 10–68 mm, which formed the basis of the account of development of the species by Hildebrand and Cable (1938), and a study was made of the development of the bands in this species.

At 10 mm the bands are not sharply outlined, but the chromatophores are already crowded in definite transverse areas which are separated by narrower intervals that are almost devoid of chromatophores. By this arrangement the number of bands in fish as small as 10 mm is determinable. On growing another 2–5 mm, the bands become sharply outlined.

Table 4 shows the grouping of the variants with respect to size. They are present in the smaller size groups and evidently disappear with growth. The largest 5-banded fish is 74 mm, the largest asymmetrical specimen 53 mm. Speci-

mens 92 mm or longer, 24 in all, have a symmetrical 6-banded pattern. An obvious and plausible explanation is that in *probatocephalus* an asymmetric and a 5-banded color pattern is linked with a lethal factor which results in the failure of such variants to reach some size, much less to reach adulthood. It can hardly be explained that the asymmetric or 5-banded pattern changes with growth to a 6-banded pattern, as the position of the bands is constant and there would have to be a radical rearrangement of the chromatophores to produce this change, which is hardly probable. The isolating mechanism that keeps *probatocephalus* and *oviceps* as separate species, therefore, seemingly includes two factors, one geographic, and another which may be termed physiologic, using the term in a broad sense. While the evidence is not based on a sufficient number of specimens to be altogether conclusive, it is fairly presumptive of this conclusion.

Family SCIAENIDAE

Menticirrhus focaliger, n. sp.

GULF MINKFISH

D X; I 24–25. A I (7) 8. P 19–21. Sc 75–86. Dorsal rays 24 (in 6) or 25 (in 5). Anal rays normally 8 (in 26), infrequently 7 (in 1). Dorsal and anal spines constant (in 11). Well elongate; rather fusiform, but tapering posteriorly more than anteriorly and upper profile more curved than lower. Snout long, bluntly rounded at tip, somewhat conical, projecting beyond upper lip. Mouth small, nearly horizontal, notably inferior, placed well behind tip of snout. Maxillary ending under middle of eye or posterior margin of pupil. Interorbital subequal to eye diameter. A single, short, rather stout, truncate barbel at chin. Lower jaw with five pores, one on midline of chin, at base of barbel, two on both sides. Anterior margin of snout with four lobes well developed. Teeth in jaws in rather broad bands; small, except outer teeth in upper jaw rather well enlarged, the others subequal; vomer and palatines toothless. Gill rakers short, rather stout, stumpy, comparatively few, the anterior 2 or 3 gill rakers on lower limb better marked in the smaller specimens, reduced to low tubercles or to a few spinules at the surface or hardly perceptible in the larger specimens (hence the tubercles were not counted, and the gill raker count differs with size), 5 + 7–10 in the smaller specimens (four specimens 53–81 mm), 5 + 6–8 in the larger (six specimens 90–132 mm). Hard part of opercle ending in two widely separated, moderately pungent or flexible points, without well marked spines. Preopercle moderately serrulose or crenate, the points moderately pungent or flexible. Scaled all over; except a moderate area at anterior end of snout naked; scales on chest subequal, the middle scales not notably smaller than those at periphery; scales on lateral aspect of snout and anterior part of cheek cycloid, others ctenoid; proximal part of caudal scaled, distal part scaleless, except the modified lateral line scales extending to its distal margin; ventral and pectoral scaled for a short distance at base; a single row of scales on second dorsal base; spinous dorsal and anal scaleless. Spinous and soft dorsal well separated, forming two fins; the spines flexible; second to fourth spines prolonged, the third longest; extent of prolongation varying greatly with the individual and increasing with growth, tip of longest spine reaching base of third to eighth dorsal ray in specimens 53–103 mm (25 fish), to base of ninth ray in specimens 115–132 mm (2 fish). The single anal spine flexible in the larger specimens, moderately pungent in small ones. Ventral placed at some distance behind pectoral base, falling considerably short of anus. End of pectoral falling a little short of a vertical through end of ventral in the smaller specimens, extending to or a little behind that vertical in the larger fish. Caudal asymmetrical, lower part rounded, longer than upper part, the latter emarginate.

Measurements of six specimens 90–132 mm, including the holotype expressed as a percentage of standard length: Caudal (lower part) 25–27.5, ventral 18–20, pectoral 20–22, depth 24–25, head 30–31.5, maxillary 10.5–11, snout 10–11, eye 6–7.5, interorbital 6.5–7.5.

Ground color light yellowish or grayish; with dusky or black rather wide bands; four oblique bands under dorsal fin running downward and forward, the first band under end of spinous dorsal continued upward on posterior part of fin, the fourth at some distance before end of soft dorsal, the bands decreasing in length and increasing in obliquity from first to fourth; two oblique bands on nape running in opposite direction to preceding series, downward and backward; the first band of the posterior series and the second band of the anterior series forming a broad V on side; caudal with a dusky longitudinal band along middle of its lower half, often rather faintly continued forward on posterior part of

TABLE 5.—FREQUENCY DISTRIBUTION OF THE NUMBER OF SCALES AND PECTORAL RAYS OF MENTICIRRHUS FOCALIGER AS COMPARED WITH M. SAXATILIS.

Species	Scales																															Pectoral rays			
	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	18	19	20	21
focaliger	1	1	2	2	4	4	4	1	2	1	2	2																			2	3	17	4
saxatilis:																																		
North Carolina															2		3	1	1		2	1	1	1								1	2	8
Woods Hole																			1		2	1		2	1	1	1	2		1			10	6

body. The oblique bands described above are sometimes sharply black and sometimes hardly perceptible. Usually they are of a diffusely dusky pigment. In general the bands are better marked in the smaller specimens. In life they are more sharply outlined than in preserved specimens.

Holotype.—U. S. N. M. no. 144161. St. Joseph Bay, Fla., near its entrance; Isaac Ginsburg; June 21, 1932; 132 mm.

Paratypes.—Five specimens 90–114 mm, obtained with holotype (U. S. N. M. no. 144163). Cape San Blas, Fla.; Isaac Ginsburg; June 20, 1932; 21 specimens 53–103 mm (U.S.N.M. no. 144162; C.N.H.M.).

Remarks.—I obtained the above 27 specimens on two successive days at two localities not far apart by means of a 30-foot seine on sandy beaches. Several drags of the net were made at each place and every drag brought in one or more specimens of *focaliger*. Very likely I could have obtained more specimens by further seining; but at the time I thought that they represented the common *saxatilis*. At Cape San Blas, 38 specimens of *M. americanus* and 5 of *M. littoralis* were obtained in the same drags as the 21 *focaliger*. Evidently the three congeneric species live and mingle side by side.

This species is close to *M. saxatilis* from the Atlantic, nearly agreeing with it in normally having 8 anal rays, in the extent of prolongation of the dorsal spines, in the color pattern and the size of the scales on the chest. It differs chiefly in having a lower scale count as shown in Table 5. While counts of more specimens might show some overlap in the distributions of the two species, the extent of divergence is evidently of species magnitude or very close to it. The populations of *saxatilis* from Woods Hole and North Carolina also differ in the scale count, possibly to an extent to be treated as distinct subspecies; but such is not unusual for north and south populations of the same species. The pectoral count of *focaliger* is nearer to the Woods Hole population of *saxatilis* than to the North Carolina population.

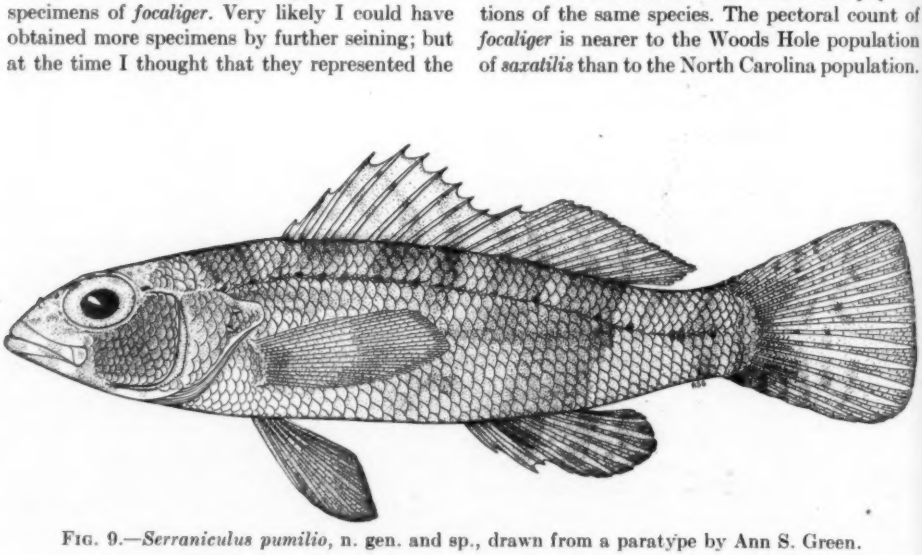


FIG. 9.—*Serraniculus pumilio*, n. gen. and sp., drawn from a paratype by Ann S. Green.

NOTES ON THE GEOGRAPHIC DISTRIBUTION OF THF FISH FAUNA OF THE EAST COAST OF THE UNITED STATES WITH PARTICULAR REFERENCE TO THREE OF THE SPECIES ESTABLISHED ABOVE

The relationship of the temperate-water, marine fish fauna of the Atlantic and Gulf coasts of the United States constitutes an interesting problem in zoogeography. The peninsula of Florida forms an effective natural barrier to the spread, and results in the isolation, of fish populations. The Gulf fish fauna from the Rio Grande (very little is now known of the fishes on the Mexican coast), say, roughly to Cape Romano, Fla., is on the whole very similar to the temperate-water fish fauna of the Atlantic coast of the United States. Most species of both coasts are nearly identical (with some qualifications as discussed below). The southern limit of the temperate Atlantic fauna is somewhere between Cape Canaveral and Biscayne Bay, Fla. The fauna of the extreme end of southern Florida, on the other hand, from Biscayne Bay to Tortugas, is in its larger aspects tropical and very similar to or nearly identical with the West Indian fish fauna and that of central and the tropical part of South America. The very similar temperate fish faunas of the Atlantic and Gulf coasts are thus isolated by the physical barrier of the peninsula of Florida and by the ecological barrier of the tropical waters at the Florida keys.

The division between the temperate water and tropical fish faunas is not sharp. Many species do have a discontinuous geographic range. They occur on the Atlantic and Gulf coasts of the United States; but their geographic distribution is interrupted by their absence at the Florida keys. On the other hand, from the viewpoint of zoogeography, a second category contains many species, in the families Carangidae and Lutianidae for instance, which have a continuous range, from the Atlantic coast, around the Florida keys, to the Gulf coast and also to the West Indies and Central America. The ichthyofauna at the Florida keys is not well enough known to make a numerical comparison of the species in these two categories. Whatever the relative number of species in the two categories, those species which by their preponderance in numbers give character to the fauna, have a discontinuous distribution. For instance, the temperate-water channel bass, croaker, spot, sea trouts, and menhaden, species that dominate the faunal scene by their abundance, have a discontinuous distribution. Also, most species having a continuous geographic range, typically belong rather to the tropical fauna. Their center of abundance is at the West Indies, the Florida keys and the coast of Central America, and occur only sparingly farther north on the Atlantic and Gulf coasts of the United States. Fewer species with a continuous geographic range, such as the sheepshead and the pigfish, typically belong to the temperate water fauna and occur in much reduced numbers at the Florida keys.

As a general rule species are not uniform morphologically throughout their geographic ranges; they differ more or less with the local population. Two species having a continuous distribution, which I have studied in detail, namely, *Bathygobius soporator* (Cuvier and Valenciennes), sensu lato (Ginsburg, 1947), and *Bathystoma aurolineatum* (C. and V.), sensu lato (1948) show that the populations of the Florida keys are somewhat intermediate, between the comparable West Indies populations and those farther north on the coast of the United States.

Comparisons made of the corresponding pairs of populations—one from the Atlantic, the other from the Gulf—of species having a discontinuous geographic range show that they too diverge more or less morphologically. The extent of divergence of comparable pairs is of different degrees and their magnitudes form a graded series, from very slight to very pronounced, with all gradations in between. (A difference in degrees of divergence among species of the same genus even, is mentioned above under the account of *Centropristes melanus*.) An example near the low end of the series is furnished by the Atlantic and Gulf populations of *Cynoscion nebulosus* as discussed by me in another paper (1938), which also gives a number of other, graded divergences at or below the subspecies level. The divergences of two corresponding pairs, namely, *Brevoortia tyrannus* from the Atlantic as compared with *B. patronus* from the Gulf, and *B. smithi* as compared with *B. gunteri*, recently published by Hildebrand (1948), are evidently of higher degrees, near the borderline between species and subspecies. The divergence of two pairs compared above, namely, *Centropristes striatus* with *C. melanus* and *Menticirrhus saxatilis* with *M. focaliger*, is approximately the same as the above named two pairs compared by Hildebrand. Finally, as an example near the other extreme, that of very pronounced diver-

gence, the two species of *Stenotomus* may be cited. *S. chrysops* (Linnaeus) is common on the Atlantic coast of the United States and is replaced on the Gulf coast by *S. caprinus* Bean which is not known to occur in the Atlantic. This is an example of two closely related allopatric species which replace each other geographically but which are so highly divergent that they are often placed by authors in separate genera.[1]

In sum, subject to the qualifications and exceptions discussed, by and large, the fish fauna of the Florida keys is tropical and West Indian, while that of the Gulf is very similar to the temperate water Atlantic fauna. The two very similar temperate water faunas are isolated by the peninsular barrier. This barrier is such a striking feature in the geographic distribution of the ichthyofauna that it could not have escaped the notice of students of fishes. But it is only lately that a beginning was made towards a detailed study and evaluation of the results of its influence on the ramification of fish populations. In any further studies, it would be interesting to note whether the change in the general character of the fauna at the lower end of the peninsula of Florida is fairly abrupt or gradual, and if abrupt at what area the change occurs.

The geographic distribution of three species described here is not in line with the general relationship of the temperate faunas on both sides of the now existing peninsular barrier as discussed above. The sheepshead, *Archosargus probatocephalus*, is one of those fewer among the typically temperate-water species that have a continuous geographic distribution, occurring as it does, in reduced numbers, in the Florida keys. A comparison of the specimens examined from Tampa Bay and Homosassa with those from the Atlantic coast makes it evident that any divergence that might exist between the Atlantic and west Florida populations will prove to be of very minor degree, decidedly below the subspecies level. This relationship is similar to that of the populations of many other species on the opposite sides of the peninsular barrier. However, in the case of the sheepshead, something different is also indicated. The population on the west coast of Florida differs materially from the comparable population on the coast of Alabama, Louisiana, Texas, and Mexico, the difference being such that they may be treated as distinct species; that is, on the Gulf coast westward of Florida *probatocephalus* is replaced by a distinct species, *oviceps*. A similar, though not parallel, difference in distribution is indicated further by two other species here described, *M. focaliger* and *C. melanus*.

The two species of *Menticirrhus* compared above, *focaliger* and *saxatilis*, are examples of two corresponding populations that replace each other on the two sides of the peninsular barrier and that have attained a divergence of species magnitude. This also is not unusual. Similar instances have been cited above. However, *focaliger* apparently does not occur on the Gulf coast westward of Florida. Of the thousands of specimens I closely examined or observed on the coast of Louisiana and Texas, not a single *focaliger* was found; they all comprised two species, *americanus* and *littoralis*, which also occur on the west Florida and Atlantic coasts. *M. focaliger* is also lacking among the many specimens of *Menticirrhus*, which John C. Pearson preserved during his study of the sciaenids of the Texas coast, and it was not found in the National Museum. It seems safe to conclude, therefore, that it does not occur in the Gulf west of Florida. Apparently this also holds for *Centropristes melanus*. The latter species has been masquerading heretofore under the name *C. striatus*. There are no indisputable records of its having been taken westward of Florida. I have not encountered it in my collecting trips from Alabama to Texas; and no specimens from the coast of those States are present in the large collection of *Centropristes* in the National Museum. Weed (1937) gives an extensive annotated bibliography of *Centropristes*. None of the references cited contain an undoubted record of the black seabass west of

[1] As the above statements regarding *Stenotomus* are at variance with published accounts, it should be here said that they are based on original and as yet unpublished data and observations. I did this work in preparing an account of the Gulf coast fishes. The specimens of *Stenotomus* examined from the Atlantic range from the Bay of Fundy in the north to Cape Canaveral, Fla; those of the corresponding population in the Gulf range from Pensacola, Fla., to Aransas Pass, Tex. Of the Atlantic material a few specimens from near the extremes of their geographic range were studied in detail and compared with those in the Gulf. All available specimens, more than 100 in number, were then examined for the most critical distinguishing characters. As a result of these studies I have come to the conclusion that only two species of the common scups are known, namely, *Stenotomus* (*Stenotomus*) *chrysops*, which is confined to the Atlantic, and *Stenotomus* (*Otrynter*) *caprinus*, which is confined to the Gulf. Judged by analogy, by the distribution of *Archosargus probatocephalus*, as determined during this investigation and recorded above, *S. chrysops* might occur in western Florida, but this remains to be determined.

Florida. One reference, that by Collins and Smith, recording *C. striatus* as being a commercial species in Mississippi, is most probably based not on actual specimens but on reports of fishermen and fish dealers, and it very likely refers to some other species designated "seabass" in the fish trade of Mississippi, rather than to *Centropristes*. The specimens that Weed designated as *striatus* and that are designated above *melanus* all came from Florida.

Still another example, again not altogether parallel, is furnished by the species of *Hippocampus* (Ginsburg, 1937). *H. zosterae* occurs on the coast of Florida and is replaced on the coasts of Mississippi and Texas by the closely related and morphologically somewhat overlapping *H. regulus*. This case is not altogether parallel in as much as *H. zosterae* is not known to occur in the Atlantic north of Biscayne Bay; but it indicates a marked difference in the fish fauna between the Gulf coast of Florida and the coast westward of Florida.

The peculiar geographic distribution of the four species discussed, as compared with their close relatives, challenges a rational explanation. On the surface the existing ecological conditions on the greater part of the Florida west coast are not so strikingly different from those of most other parts of the Gulf coast as to account for this difference in geographical distribution. Yet, in some important elements, the fish fauna of the Gulf coast of Florida differs markedly from that of the coast of Alabama and westward and is nearer to that of the Atlantic coast.

In our present state of knowledge only speculative suggestions may be made. One such suggestion would be the existence of some past or present barrier, now unrecognized. On this assumption the thought that comes to mind first is an ecological barrier, namely, the soft or muddy nature of the bottom in the delta region resulting from the tremendous mass of silt carried down by the Mississippi River. But, while this may be a partial factor in isolating fish populations, it evidently does not offer a full explanation of the peculiar distribution here discussed. Most species are able to surmount this barrier. Moreover, the fauna on the coasts of Alabama and Mississippi, on the east side of the Mississippi Delta, is the same as far as we know now as that of Louisiana and Texas, west of the delta. Another assumption would be the probable existence of a faunal barrier, similar to the now existing peninsular barrier, physical or ecological, in some past geologic epoch, perhaps the Pliocene, somewhere between what is now Cape San Blas, Fla., and Mobile Bay, Ala. This hypothetical barrier must have antedated the peninsular barrier as it now exists. It produced its effect in isolating fish populations when the west coast of Florida was still continuous with the Atlantic coast, at least when it was climatologically and ecologically uninterrupted and supporting the same fauna. The proof of such a hypothesis, of course, lies within the province of historical geology as well as zoogeography. My main object here is to place the zoogeographic evidence on record as it relates to fishes, for the purpose of correlation with similar evidence that might exist for other groups or that might be discovered in the future study of fishes.

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MAMMALOGY.—*A new* Clyomys *from Paraguay* (*Rodentia: Echimyidae*).

João Moojen, Museu Nacional, Rio de Janeiro, Brazil. (Communicated by Herbert Friedmann.)

Among the mammal specimens collected by Charles Wharton in Paraguay is an apparently undescribed form of the genus *Clyomys*. Hitherto this genus has been known only from specimens obtained by Lund at Lagôa Santa, Minas Gerais, Brazil. This new form appears to be subspecifically distinguishable, as follows:

Clyomys laticeps whartoni, n. subsp.

Type.—Museu Nacional no. 11400, adult male; collected on May 5, 1950, by Charles Wharton.

Type locality.—1 km north of Aca-poi, long. 56°7′ W., lat. 23°5′ S., Department of San Pedro, Partido de Taquatí, Paraguay; approximately 60 km east-northeast of Puerto Ybapobo and 10 km south of the Rio Ypané. Specimen trapped alive at mouth of burrow in cañadon (natural opening).

Diagnosis.—Head grizzled ferruginous and black, more uniformly ferruginous on the nose and cheeks. Back rufous strongly mixed with black, the amount of black decreasing to the sides of body and caudad. Sides of the body and primna more uniform cinnamon. Tail like back in the proximal fifth, covered with stiff blackish hairs in the remaining portion. Hands and feet finely grizzled whitish and rufous with some black intermixed. Ventral surface grayish white with gray patches in the gular region and middle of chest and belly.

Pelage.—Aristiforms on shoulder: Grayish basally, gradually blackening toward tip but interrupted by an Apricot Orange subapical zone: about half of them with no subapical zone and therefore completely black in the distal part; groove of aristiforms dorsal, as in *Euryzygomatomys;* total length 18 to 20 mm; maximum width 0.5 to 0.6 mm.

Setiforms on shoulder: Whitish basally, gradually darkening toward tip but interrupted by an Apricot Buff subapical zone; total length about 18 mm; maximum width 0.1 to 0.2 mm.

Aristiforms on middorsal region: Grayish basally, gradually blackening toward tip but most of them interrupted by an Apricot Buff subapical zone; total length 20 to 23 mm; maximum width 0.8 to 0.9 mm.

Setiforms on middorsal region: Grayish basally, gradually darkening toward tip but interrupted by a broad Salmon-Buff subapical zone; total length 15 to 20 mm; maximum width 0.02 mm.

Setiforms on thighs: Almost uniformly with a broad Apricot Buff subapical zone.

Measurements.—Dry skin: Head and body, 190 mm; tail, 69 mm; hind foot (c.u.) 36 mm; ear, 16 mm.

Skull: Greatest length, 46.9 mm; basal length, 44.5 mm; zygomatic breadth, 26.5 mm; length of nasals, 14 mm; interorbital breadth, 11.7 mm; palatilar length, 17.6 mm; bullae, 14.6 by 10.4 mm; crown length of cheek teeth, 9.3 mm.

Comparisons.—This new subspecies differs from *C. l. laticeps* in having grayish patches on the gular region and median ventral surface. The palate is shorter and the bullae are larger than in *C. l. laticeps.*

Remarks.—The discovery of *Clyomys laticeps* in Paraguay considerably extends its range, showing that the species probably lives in the whole savannah region of the South American central plateau. Since it is now known from Lagôa Santa, Minas Gerais, Brazil, and Taquatí, Paraguay, it should follow the pattern of distribution of other genera in the same family, as for instance *Cercomys*, *Euryzygomatomys*, and *Carterodon*, which live in similar habitat.

The fact also that Mr. Wharton was not able to find the species in Summerfeld Colony, Department of Yhú, lat. 25°20′ S., and long. 55°45′ W., supports the assumption that most of the Echimyidae do not go below lat. 24° S. in spite of topographical and floristical conditions.

Mr. Wharton intends to publish on the habits of the subspecies.

An old adult female was also examined, collected by Mr. Wharton in the same locality, and will be deposited in the U. S. National Museum collection. The color of this specimen is considerably lighter than that of the type, the subapical zone of the aristiformes being Salmon-Buff. Its measurements are: Skin (in the flesh): Head and body, 107 mm; tail, 75 mm; hind hoot, 21 mm. Skull: Greatest length, 47.1 mm; basal length, 44.1 mm; zygomatic breadth, 26.5 mm; length of nasal, 13.0 mm; interorbital breadth, 10.9 mm; palatilar length, 17.1 mm; bullae, 14.4 by 10.1 mm; crown length of cheek teeth 9.1 mm.

ORNITHOLOGY.—*A new finch from northern Perú.* JOHN T. ZIMMER, American Museum of Natural History. (Communicated by Herbert Friedmann.)

A small consignment of Peruvian birds, recently submitted by Javier Ortiz de la Puente, of the Museo de Historia Natural 'Javier Prado' of Lima, Perú, contained, among other interesting specimens, a fine new finch belonging to the genus *Incaspiza*. Señor Ortiz de la Puente has kindly given me permission to describe this new bird and, in addition, has generously given the type to the American Museum of Natural History, for which I am grateful.

I am also indebted to Rodolphe M. de Schauensee, of the Academy of Natural Sciences of Philadelphia, for the loan of a specimen of one of the allied species of *Incaspiza*, not contained in the American Museum series, and one additional young individual of uncertain affinity. Both examples were examined some years ago but were studied again in comparison with the new form.

The new bird may be known as follows. Names of colors are capitalized when direct comparison has been made with Ridgway's *Color standards and color nomenclature*.

Incaspiza ortizi, n. sp.

Type.—From near La Esperanza, Dept. Cajamarca, Perú; altitude 1,800 meters. Amer. Mus. Nat. Hist. no. 748395. Adult female collected April 24, 1951, by Javier Ortiz de la Puente.

Diagnosis.—Somewhat similar to *I. pulchra* of central-western Perú (Departments Ancash to Lima at approximately the same elevations) but differing in various respects. Upper parts darker and duller, more streaked and without any bright rufescence; gray of breast lighter and clearer, being broadly extended down the flanks; belly white, without buff; facial pattern different, having broader black on the front and a more restricted black gular patch, which, however, is broadly connected with the lores; no gray superciliary stripe over the lores and only a weak suggestion of one between the black orbital ring and the crown; feet paler yellowish. The facial pattern rather noticeably resembles that of *I. personata* (of even higher elevations in the Cajamarca region), giving the only obvious feature of resemblance to that species.

Range.—At present known definitely only from the type locality, on the western side of the Andes of northern Perú. Possibly crossing the Andes to the eastern slope of the Western Cordillera.

Description of type.—Crown Deep Mouse Gray with poorly defined darker shaft streaks; back of head a little lighter; mantle Hair Brown × Mouse Gray with rather broad, sooty shaft streaks, not sharply defined; forehead broadly black with the shading extending over the lores, narrowly around the orbit, broadly over the malar apex, and moderately broadly over the chin; rest of sides of the head Neutral Gray × Light Neutral Gray, merging with the Pale Neutral Gray of the throat; breast a little lighter, with traces of whitish shaft lines; flanks broadly Pale Neutral Gray; belly white; under tail coverts whitish, faintly tinged with light buff. Remiges near Hair Brown; primaries with exterior margins finely Drab-Gray; secondaries with this outer margin broader and less well defined; tertials with a brown submarginal area passing into a grayer margin; upper primary coverts dusky with dull grayish margins; greater coverts like the secondaries; median and lesser series gray with lighter margins; under primary coverts dull grayish; remainder of under coverts whitish; inner margins of remiges soiled whitish. Median three pairs of rectrices blackish with prominent gray margins tending to broaden at the tips (worn plumes faded to brown); fourth pair blackish, with a large white patch on the terminal part of the inner web, adjoining the shaft but withdrawn from the inner margin except for a short distance terminally; subexternal pair similarly marked but the white patch reaching well over half the distance basad along the shaft and a third of the distance on the inner margin; outermost pair with the white even more extensive, involving most of both webs except for a dusky diagonal patch at the base and a narrow streak on the outer web near the tip. Bill (in dried skin) Capucine Yellow × Deep Chrome; feet Maize Yellow. Wing, 73 mm; tail, 67; exposed culmen, 14.5; culmen from base, 18; tarsus, 26.5.

Remarks.—A young male from Hacienda Limón, Perú, kindly lent by Mr. de Schauensee, of the Academy of Natural Sciences of Philadelphia, may be an immature example of the present species, but it is impossible to be certain without adults from the same locality. I have no comparable plumages of *pulchra* or *personata*, but the

characters of this young bird approximate those of adult *ortizi* more than those of either of the other forms. The bill is of much the same conformation; the upper parts are strongly streaked, and the pattern of the tail is very similar. The under parts are dull with prominent pectoral streaks, and there is no facial black although the lores and malar apex (but not the forehead or chin) are somewhat dusky. There is, however, a rather broad superciliary stripe over the orbit and the lores to the base of the bill which may indicate relationship to *pulchra* more than to *ortizi*. For the present I prefer to leave this bird with a query.

The possibility exists that *ortizi* and *pulchra* are conspecific or even, as maintained by Hellmayr, that *pulchra* and *personata* bear that close relationship, but I believe the situation is not sufficiently clear to establish such arrangement without question. The various members of the genus *incaspiza*, including several species that are rather obviously no more than generically related to these three forms, all exhibit notable similarities in pattern of coloration, and the possession of one or more resemblances of this sort in common is not an adequate criterion of conspecific affinity.

I have been handicapped to a certain extent by lacking a female of *pulchra* or a male of *ortizi*. Throughout the genus *Incaspiza*, however, the sexes show no striking distinctions. Furthermore, both sexes of *pulchra* were studied by Hellmayr, who reported no differences except of size; a female was slightly smaller than two males. Consequently I am confident that the characters of *ortizi* can not be attributed to any sexual differentiation.

I take great pleasure in naming this fine bird for its discoverer.

Specimens examined.—As follows:

I. ortizi.—PERÚ: La Esperanza, 1 ♀ (type).

I. pulchra.—PERÚ: Yuramarca, Dept. Ancash, 1 ♂.[1]

I. personata.—PERÚ: Cajabamba, 2 ♂; near Cajamarca, 2 ♂, 4 ♀; Succha, 1 ♀.

I. species?.—PERÚ: Hacienda Limón, 1 ♂ juv.[1]

[1] Specimens in Acad. Nat. Sci., Philadelphia.

Obituary

MERRILL BERNARD was born at Burlington, Iowa, on July 25, 1892. He died in his home in Washington, D. C., on April 13, 1951. He is survived by his wife Claudia Bernard.

Bernard completed his education at the North Carolina Military Academy (Preparatory), Military College of South Carolina, and A. and M. College o. Oklahoma, after which he practiced municipal, irrigation, and railroad engineering in Louisiana and Texas. After military service as first lieutenant during the First World War (1917–18) he engaged in consulting engineering practice in Louisiana, Texas, and Central America, including hydrologic consultant for the Mississippi Valley Committee in 1934–1936, and brief associations with the U. S. Geological Survey and the Soil Conservation Service. He became chief, River and Flood Division, U. S. Weather Bureau in 1937, advancing to hydrologic director, 1939, and finally chief, Climatological and Hydrologic Services, in 1946, the position he held at the time of his death. Among the special assignments he accomplished were those of member, American Meteorological Mission to USSR (1945), and meteorological attaché to embassy, Moscow (1946).

His many contributions in the fields of hydrology and meteorology are notably important for their success in clarifying the relationship between these two sciences. His paper *Primary role of meteorology in flood flow estimating* won for him the Norman Medal of the American Society of Civil Engineers in 1945.

In addition to his association with this Academy, Merrill Bernard was affiliated with the Internation Association of Hydrology, IUGG, of which he was president; International Meteorological Organization, in which he served as president of their joint subcommittee on machine methods, and vice president of their technical commission on hydrology; American Meteorological Society; American Geophysical Union; and American Society of Civil Engineers.

His widely recognized abilities and professional prestige, combined in action with his personal likability and unvarying loyalty to the Service, gained for the Weather Bureau a great many advantages in its work with such other agencies as the Corps of Engineers, the Bureau of Reclamation, and the U. S. Geological Survey, with whose cooperation, under his active guidance, many major projects of public benefit and value have been developed and are now in continuing operation. Outstanding examples of these are the objectives and output of the hydrometeorological and the cooperative studies sections of the Climatological and Hydrologic Services Division in Washington for which his vision and ingenuity are very largely to be thanked, and which have become indispensable as aids in relating the facts and potentials of storm behavior to the design and location of flood-control and water-conservation construction throughout the country. Less well-defined but of comparable character and value was the success of his effort to extend the flood-forecasting function of the Weather Bureau to upstream and headwater areas.—W. F. F.

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